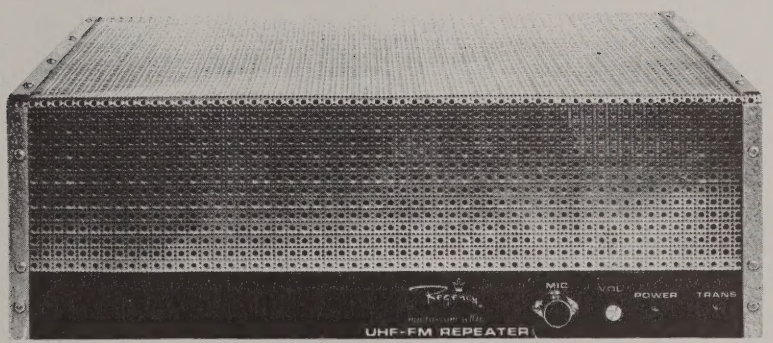
Regency® ELECTRONICS INC.

INSTRUCTION & SERVICE MANUAL



MODEL MICRO COM U10r

UHF FM REPEATER

7001-4001-100 PRINTED IN U.S.A. PRICE $12.50

UNPACKING

Check the carton and packing material carefully for the following items:

1 - Repeater unit
1 - Microphone and Connector
1 - Owner's Service Manual
1 - Warranty Card

To be filled out and returned to:

REGENCY COMMUNICATIONS, INC.
A subsidiary of Regency Electronics, Inc.
1227 South Patrick Drive
Satellite Beach, Florida 32937

MICRO-COM U10R SERVICE MANUAL

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SECTION I

GENERAL INFORMATION

SECTION 1 GENERAL INFORMATION

1-1 DESCRIPTION

The Regency MICRO-COM U10R is an FM repeater for use in the 450-470 MHz Land Mobile Communications Band. It is equipped with facilities which permit local control of the repeater, for use by a dispatcher and/or for use by maintenance personnel in making tests on the repeater.

As supplied, the repeater may be mounted on a desk or shelf. When equipped with Option MA-109 brackets, it may be mounted in relay rack structures.

The repeater control system provides for the following functions:

1. Operation of the transmitter by tone squelch or noise squelch control.

2. Provisions for plugging in up to seven tone squelch frequencies, for use on community repeater systems. Additional tone squelch frequencies may be added outboard, if desired.

3. Three minute cutoff timer, with warning tone.

4. Transmitter drop out delay.

5. Provisions enabling operation of the repeater by a local operator. These provisions also enable maintenance technicians to receive and transmit test transmissions using each of the installed tone squelch frequencies.

The receiver section is certified under Part 15, Subpart C of the FCC Rules. The transmitter is Type Accepted under the following FCC Rules parts:

21 Domestic Public Radio Services
89 Public Safety Radio Services
91 Industrial Radio Services
93 Land Transportation Radio Services
95 Citizens (Class A) Radio Services

1-2 SPECIFICATIONS

RECEIVER

Antenna Impedance	50 Ohms
Frequency Range	450-470 MHz
Sensitivity	.35uV, 12 DB Sinad
	.50uV, 20 DB Quieting
	.25uV, Carrier Squelch Opening
	.25uV, Tone Squelch Opening
Selectivity	75 DB @ 25 KHz
Spurious and Image	75 DB
Intermodulation Rejection	70 DB
Modulation Acceptance	±7.5 KHz
Frequency Stability	±.00025%, -30°C to +60°C
Audio Response	Within plus 2 and minus 8 DB from a standard 6 DB per octave de-emphasis curve over the frequency range of 300 to 3000 Hz with a 1,000 Hz reference frequency
Audio Output Power, Rated Value	4 watts @ 5% distortion
Maximum Audio Output Power	5 watts @ 10% distortion
I.F. System	Double Conversion 10.7 MHz - 455 MHz

Part 15 FCC Certified

TRANSMITTER

Antenna Impedance	50 Ohms
Frequency Range	450-470 MHz

Power Output	10 Watts (minimum)
Output Frequency Stability	±.00025%, -30°C to +60°C
Spurious & Harmonic Rejection	60 DB
Power Unit Protection	Temperature Limiting Power Control Circuit
Emission	16F3
Microphone	High Impedance Plug-in Ceramic
Modulation	Frequency Modulation with Automatic Deviation Limiting
Deviation	Factory Adjusted to ±5 KHz (max.)
Audio Frequency Distortion	10%
FM Hum and Noise Level	-60 DB
Audio Frequency Response	From 300 to 3000 Hz, within +1 and -3 DB of a 6 DB per octave pre-emphasis characteristic as referred to the 1,000 Hz level

POWER

Power Requirements	117 V.A.C., 60 Hz
Receive Condition	.15 amps
Transmit Condition	.8 amps
Fuse Size	2 Amp. 3AG

GENERAL FEATURES

Outside Dimensions (Excluding Knobs and Connectors)	17½" x 11¼" x 6" High
Vertical Rack Space Requirements	11¼", plus a recommended 8" for access to controls and connectors
Weight	12 lbs.

1-3 EQUIPMENT SUPPLIED

1 - Repeater Unit
1 - Test Microphone and Connector
1 - Receive Channel Crystal, installed to customer specified frequency.
1 Transmit Channel Crystal, installed to customer specified frequency.
1 - Control Board with connectors to accept three receive and three transmit CTCSS (Continuous Tone Coded Squelch System) modules.
1 - Auxiliary Tone Board, to accept four receive and four transmit CTCSS modules.
1 - CTCSS receive module, installed to customer specified frequency.
1 - CTCSS transmit module, installed to customer specified frequency.

Up to six additional CTCSS receive modules and up to six additional CTCSS transmit modules, installed per customer specified frequencies, supplied at extra cost if ordered.

1-4 EQUIPMENT NOT SUPPLIED

Because of the many varied antenna arrangements possible for repeater use, antennas, antenna connecting cables, and duplexer/cavity accessories are not supplied as a part of the repeater.

Rack mounting adaptors are not supplied as a part of the repeater.

1-5 INSTALLATION

Mechanical Mounting

The U10R is supplied for mounting on a desk, shelf, or other flat surface. For those cases where it is desired to mount the repeater in standard relay racks, mounting brackets are available. The mounting brackets may be attached to the repeater chassis to permit the "top" or equipment side to be located in front of the rack panel surface, or to the rear of the rack panel surface. If space will permit, the front surface mounting is recommended for easy access to the technician adjustments.

In some cases, it is desired that a local operator have access to control of the repeater. For these applications, the repeater may be mounted on the operator's desk top.

The microphone hang-up clip must be mounted so it is electrically grounded to the metal case of the repeater. Mount it in a convenient location, accessible to the technician, or the local operator (if any).

1-6 OPERATION INSTRUCTIONS FOR LOCAL CONTROL POSITION

The operator at the local control position should realize that the unit is a repeater, and that it performs repeater functions for various mobiles, independently of the local control operator's actions, unless interrupted by the local operator when making a transmission over the repeater transmitter.

Volume Control

This control varies the audio volume level to the local loudspeaker, and should be set to a comfortable listening level. It has no control over the volume of the repeating function, and it has no control over the volume of transmissions made over the local microphone.

Power Indicator Lamp

A green indicator lamp is located on the front panel. It is used to show that the power to the repeater unit is "on."

Transmit Indicator Lamp

A red indicator lamp is located on the front panel. When this lamp glows, it indicates that the repeater transmitter is turned on. This lamp will glow whether the repeater transmitter is activated by the local microphone or by a distant mobile.

Tone Squelch Monitoring Function: (For units equipped with Tone Squelch)

When the microphone is placed in its hang-up hook, the Tone Squelch System is effective and only signals from stations having the appropriate tones will be heard in the local loudspeaker.

On shared radio channels, it is considered good manners to listen in on the channel before transmitting. When the microphone is removed from the hook, the Tone Squelch circuits are placed in

the MONITOR condition, and any signal on the channel will be heard regardless of whether it has the appropriate tone coding.

If the operator attempts to transmit a message by merely pressing the microphone button while the microphone remains in the hang-up hook, the tone squelch tone will not be transmitted, and the message will not get through (unless the listening station just happens to be in the MONITOR position at the time).

Microphone

A hand-held microphone is supplied with the unit. To transmit a message, remove the microphone from its hang-up hook, press the push-to-talk button on the side of the microphone, and speak into the microphone. The Transmit Indicator will glow to signify that the transmitter is operating.

ults are obtained by holding the microphone about one inch from the lips, inclined at about a 30 degree angle away from the face. Speak clearly in a normal tone of voice across the face of the microphone.

1-7 CRYSTAL SPECIFICATIONS

Miniature plug-in crystals are utilized in both the receiver and transmitter sections.

The following Regency Part Number crystals are used:

Transmit Crystals: 302-539
Receive Crystals: 302-540

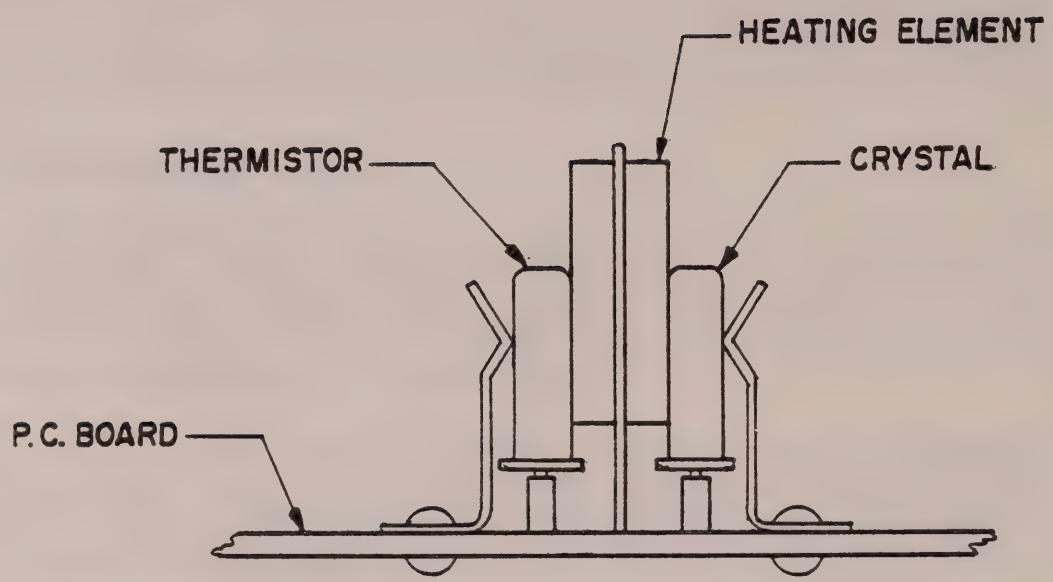
Crystals should be ordered by specifying the above part numbers and the exact channel frequency required.

Installation of crystals requires the services of a competent technician with appropriate test equipment. Instructions for the necessary adjustments are included in the receiver alignment and transmitter tuning procedures later in this manual.

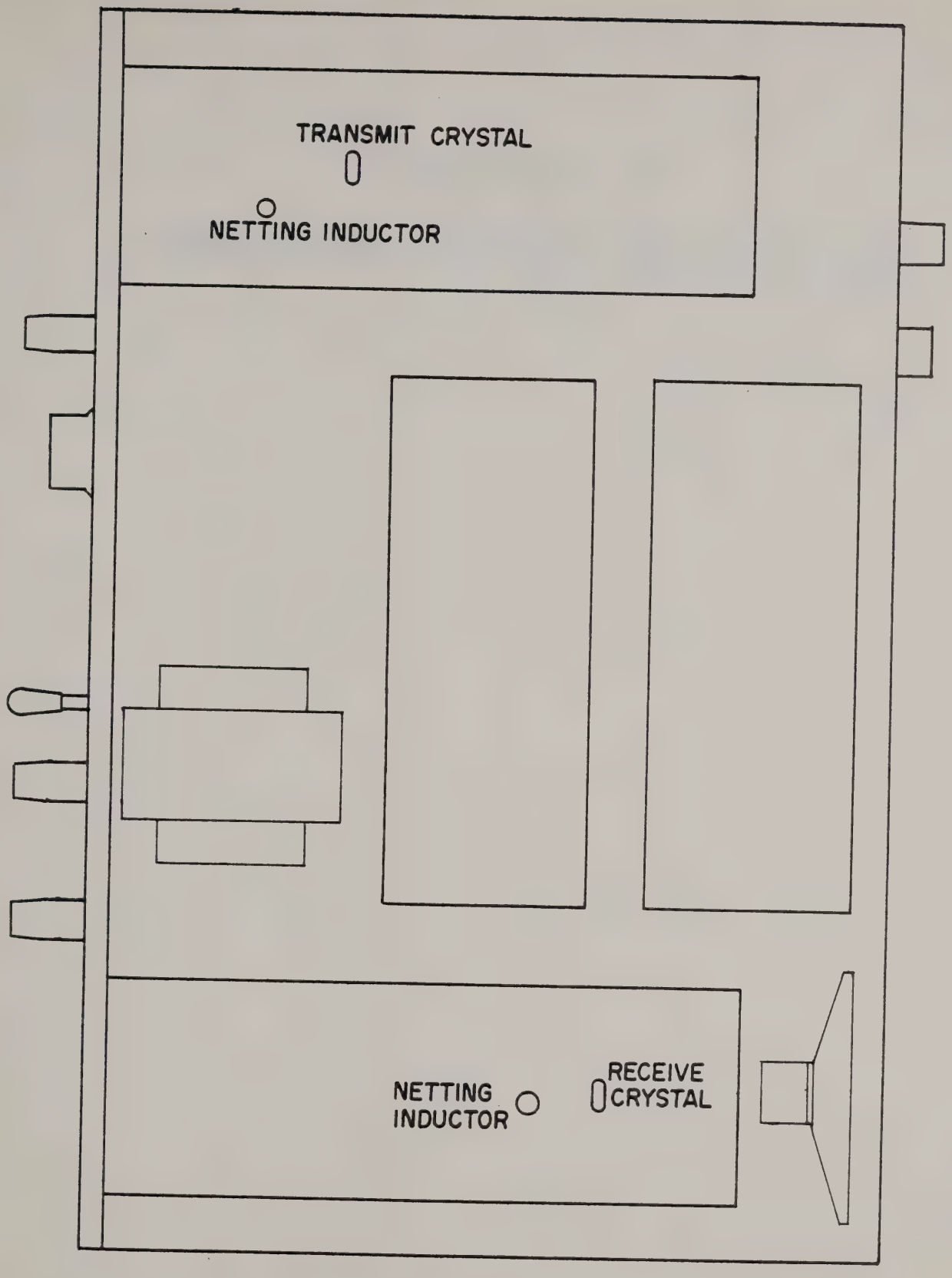
1-8 CRYSTAL INSTALLATION

Special care must be taken to install the crystals correctly. The conduction type crystal heater which is used to warm the crystals at low ambient temperatures relies on having proper physical contact between the heater element and the crystal for effective operation. The Crystal Heater Detail, (Figure 1-9) demonstrates

the correct method of crystal installation. The crystal must be pressed down into the socket pins far enough for the rim around the bottom of the crystal to clear the heating element and allow good contact between the side of the crystal and the element.



1-9 CRYSTAL HEATING DETAIL



I-10 CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM

SECTION 2
REPEATER SYSTEM DESCRIPTION

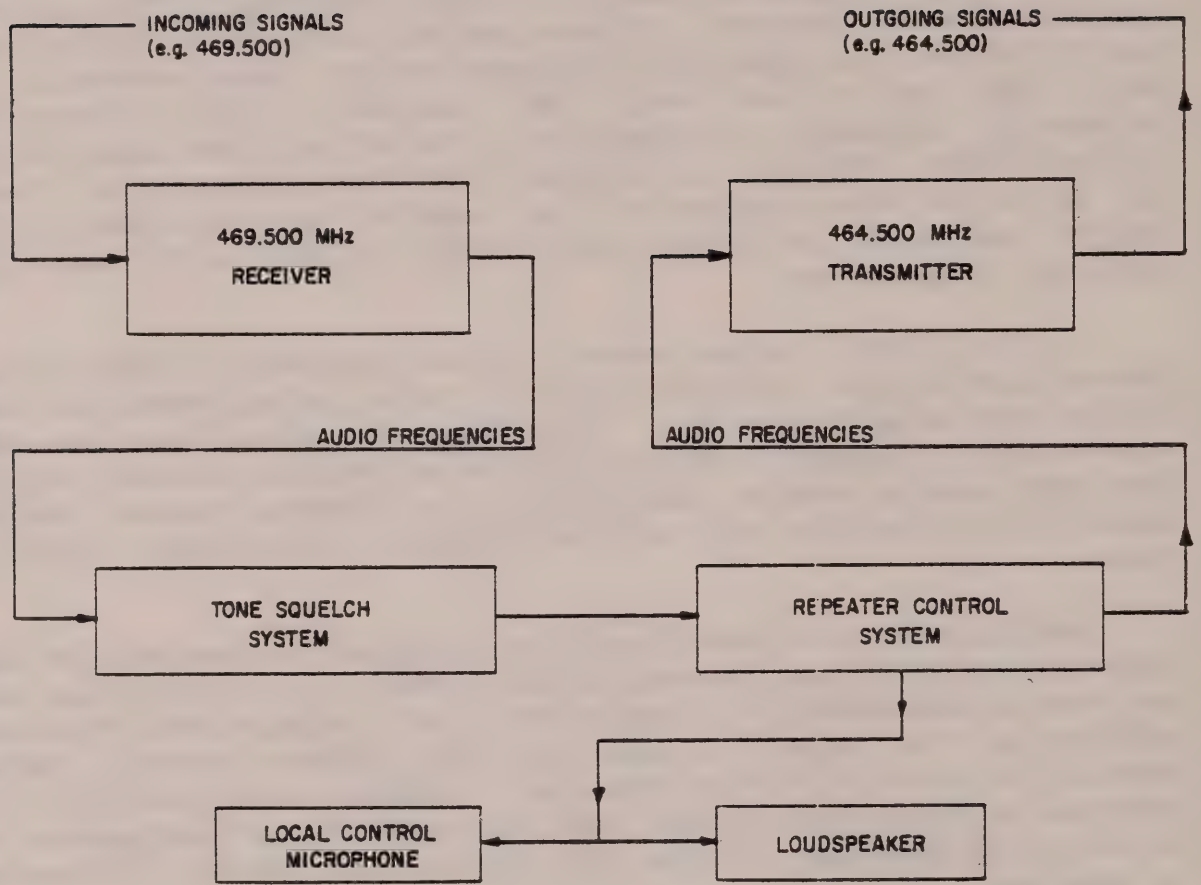
SECTION 2 REPEATER SYSTEM

2-1 DESCRIPTION

A block diagram of the repeater system is shown in Figure 2-2. The block diagram shows the major functions of the various portions of the repeater. To make explanation of the diagram easier to follow, the operating frequencies have been assumed to be 469.50 MHz receive and 464.50 MHz transmit. This follows the pattern of frequency assignments in the 450-470 MHz band in the United States. Mobiles functioning with this system would transmit on 469.50 MHz (so they will be received by the repeater receiver) and would receive on 464.50 MHz (so they will "hear" the repeater transmitter).

As the block diagram shows, signals received on 469.50 are demodulated by the receiver, and the audio intelligence is sent to the tone squelch system. If the received signal has the same tone squelch frequency as one of the installed tone squelch boards, the tone squelch system, acting with the repeater control system turns the transmitter on, and retransmits the original intelligence.

Additionally, as the block diagram shows, an operator at the repeater location can transmit through the local microphone and can hear incoming mobiles through the local loudspeaker. Features within the tone squelch system and the repeater control system permit the operator at the repeater location to transmit one of the tone squelch frequencies, and also enable the loudspeaker to be silent except when a signal with that tone squelch frequency is received.



2-2 REPEATER SYSTEM BLOCK DIAGRAM

SECTION 3
RECEIVER

SECTION 3 RECEIVER

3-1 RECEIVER CIRCUIT DESCRIPTION

The entire receiver is mounted on the receiver circuit board. The antenna is connected to a 2 Section RF Helical Filter, L109 and L110, which acts as a preselector for incoming signals.

Q105 is a grounded gate, low noise, J-FET amplifier. Its output is fed through an additional 2 Section Helical Filter, L112 and L113 and delivered to the gate of Q106, a J-FET mixer.

L.O. (Local Oscillator) injection for the J-FET mixer Q106 is a frequency of 10.7 MHz lower than the incoming signal frequency. It is obtained from a crystal oscillator-multiplier chain, consisting of Q101, Q102, Q103, and Q104. Q101 is a crystal oscillator, using a third overtone crystal in the 48.8 to 55.7 MHz range. The output circuit of Q101 oscillator is tuned to the third harmonic of the crystal frequency, and this harmonic is amplified by a buffer-amplifier consisting of Q102 and Q103. Q103 drives Q104, which operates as a frequency tripler, providing the wanted local oscillator injection frequency. This wanted injection frequency is separated from various harmonics and subharmonics by the L114 and L115 section of the helical filter and delivered to the source of the mixer, Q106.

The output of Q106 consists of a 10.7 MHz IF signal which is fed to a six-pole monolithic crystal filter, consisting of FL101, FL102, and FL103. This filter provides most of the adjacent channel selectivity of the receiver. The signal is then amplified by integrated circuit, IC102, which contains another amplifier for 10.7 MHz, the second mixer circuitry and the second L.O. circuitry, operating at 10.245 MHz.

The 455 KHz output of IC102 (terminal 5) is coupled through a tuned circuit to the input of the ceramic filter, FL104. FL104 is a narrow-band filter centered at 455 KHz, and it provides additional adjacent channel rejection. The output of FL104 is amplified and coupled through a tuned circuit to the input of integrated circuit IC103. IC103 is a series of amplifiers providing approximately 60 DB gain at 455 KHz. Also included in IC103 is the limiting circuitry and a quadrature detector circuit. L123, connected between terminals 2 and 12 of IC103, is the adjustable quadrature coil.

The audio output from IC103 (terminal L) is coupled to the input of the audio amplifier circuit and to the input of the noise-operated squelch circuit.

Transistor Q110 is an amplifier whose frequency response extends from approximately 4 KHz to 25 KHz. Q110 amplifies the noise occurring in this frequency range. The noise is coupled to the base of Q111. Q111 is used as a detector which rectifies the amplified noise and produces a DC voltage at its collector. When the DC voltage at the collector of Q111 is positive and of sufficient value to provide essentially a short circuit between the base of Q113 and the audio output from the receiver is squelched (muted). When a signal carrier arrives, the noise input to the detector (Q111) is reduced to the point where the DC voltage at the base of Q112 is no longer sufficient to cause Q112 to conduct.

At this time, Q113 is allowed to conduct normally and the audio output of the unit is heard. With the audio preamplifier, (Q113) operating normally, audio is applied through the volume control to the input of the audio amplifier, IC104. Q113 supplies a signal to the audio amplifier IC104, which amplifies the audio to loudspeaker level.

3-2 RECEIVER VOLTAGES

NOTE: All voltages are nominal and are measured with a VTVM, at 13.0 VDC supply voltage.

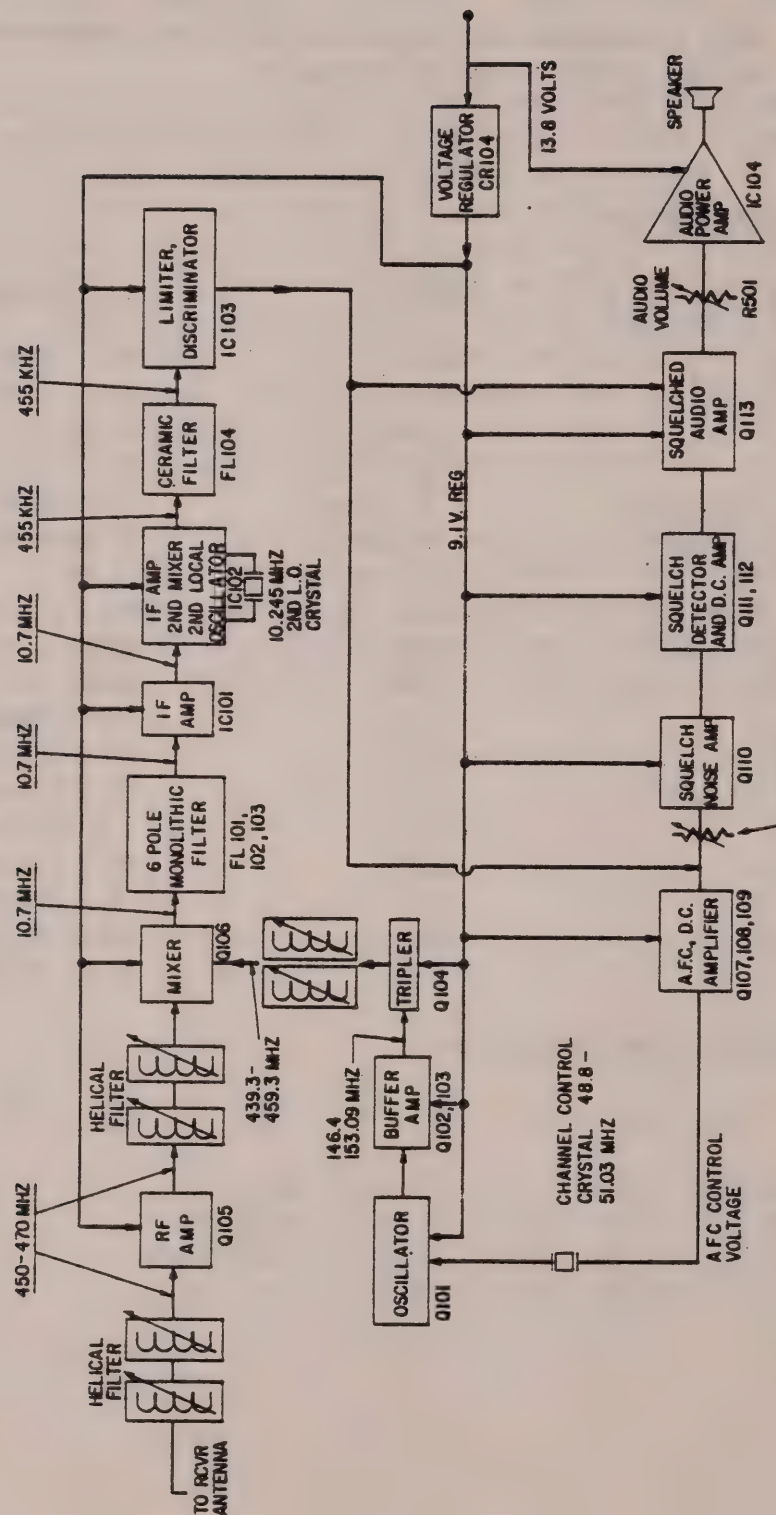
VOLTAGE DATA

Receiver Transistors:

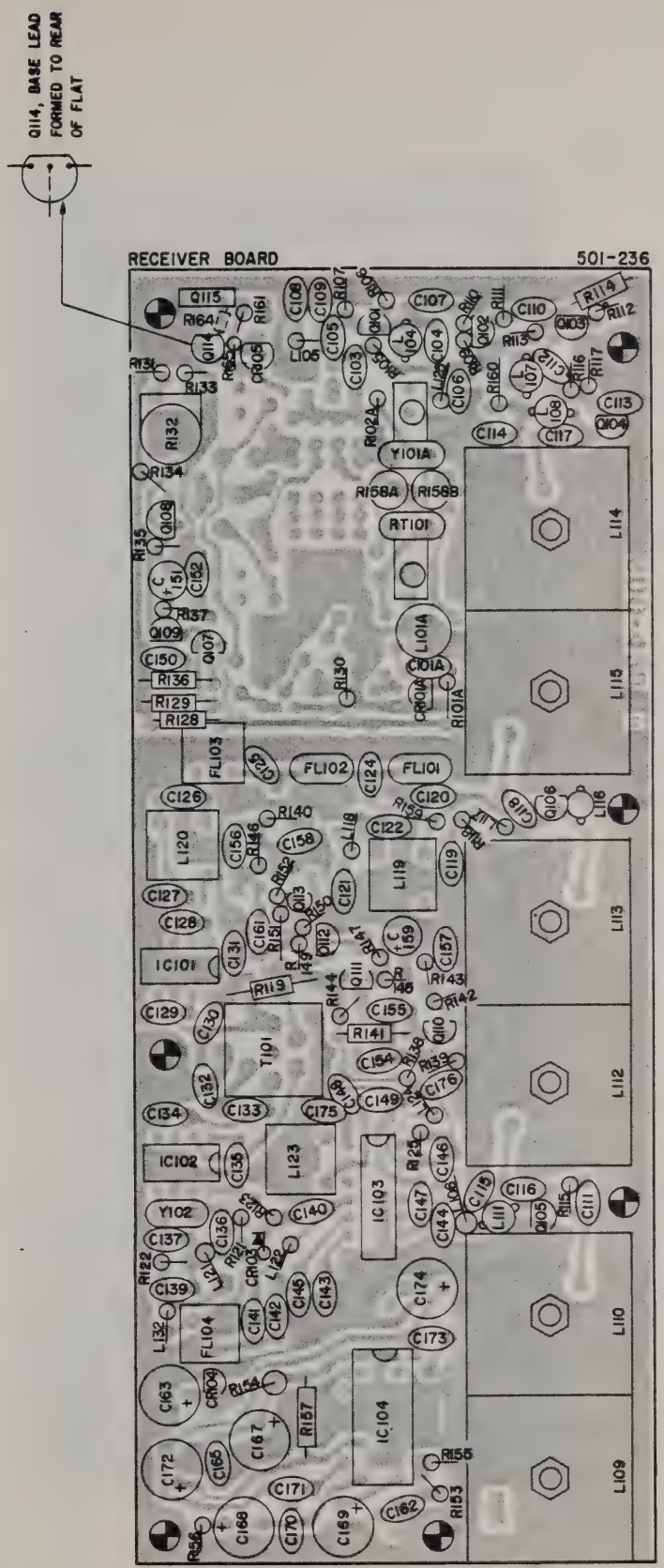
	Emitter	Base	Collector
Q101	1.1	1.5	9
Q102	4.2	5.0	9
Q103	0	0.2	5.2
Q104	0	-0.15	5.2
Q105 (FET)	1.7 (Source)	0 (Gate)	9 (Drain)
Q106 (FET)	0.9 (Source	0 (Gate)	9 (Drain)
Q107 (PNP)	8.7	8.2	5.0
Q108	3.6	4.2	8.2
Q109	3.6	4.2	8.2
Q110	1.0	1.6	5.8
Q111	9.1	9.1	0 (Unsquelched)
	9.1	9.5	9.0 (Tight Squelch)
Q112	0	0	2.6 (Unsquelched)
	0	0.7	0 (Tight Squelch)
Q113	1.3	2.6	6.4 (Unsquelched)
	1.7	0	9.1 (Tight Squelch)
Q114	0.4	0.8	13.0 @ 25°C
Q115	0	0.4	13.0 @ 25°C

Receiver Integrated Circuits:

IC No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC101	1.7	0.6	0.6	0	3.7	0	2.0	3.7	-	-	-	-	-	-
IC102	2.2	0.6	0.6	2.2	3.8	0	2.2	3.8	-	-	-	-	-	-
IC103	4.8	3.2	-	1.3	1.3	1.3	0	0	0.14	-	-	3.2	9.1	5.4
IC104	13.0	-	-	12.9	0.5	0.5	6.0	0	0	0	-	6.0	-	-

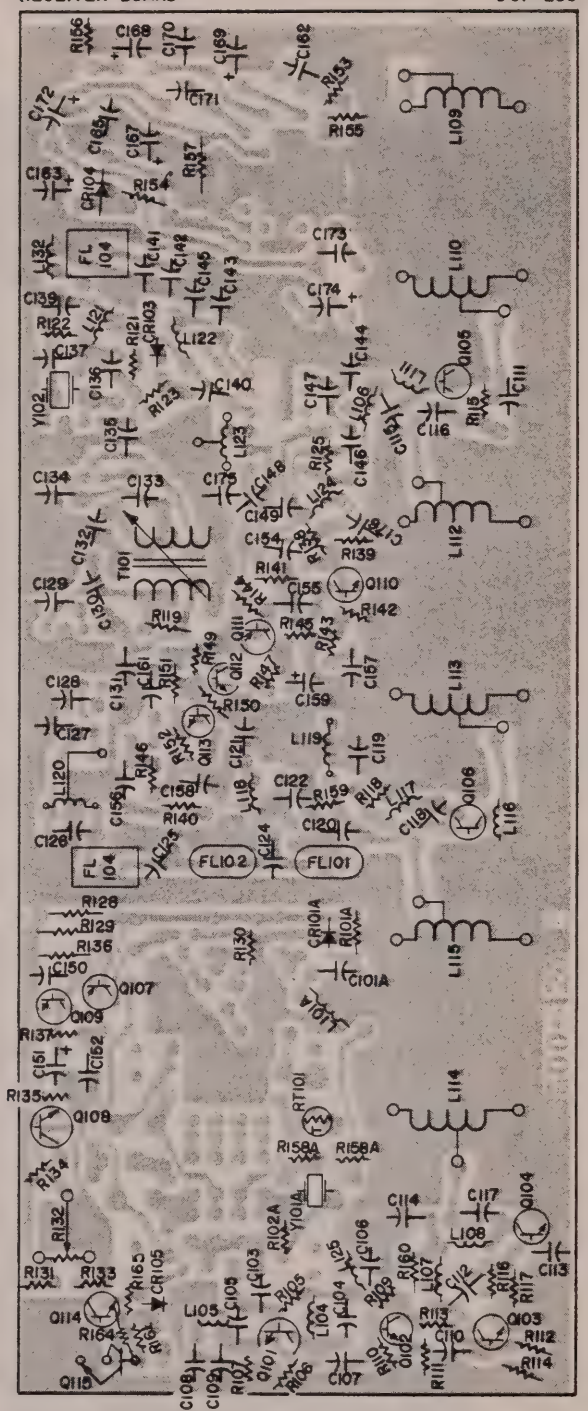


3-3 RECEIVER BLOCK DIAGRAM

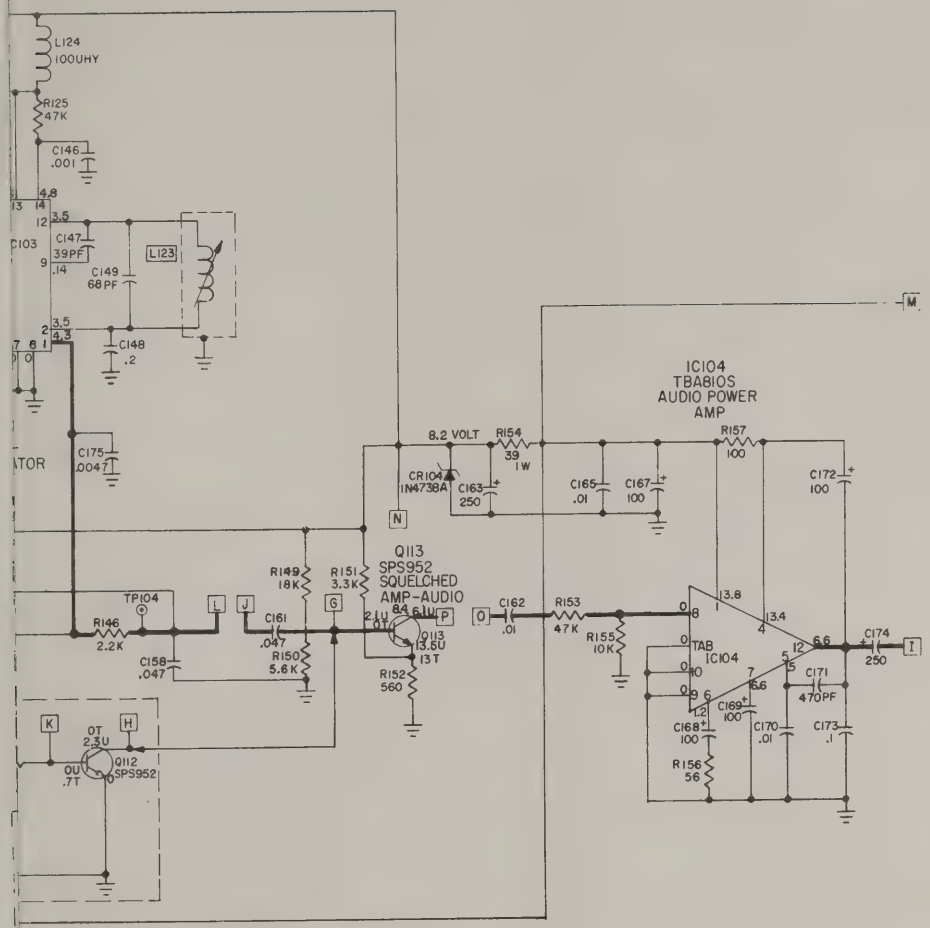


3-4 RECEIVER BOARD TOP VIEW

RECEIVER BOARD 501-236



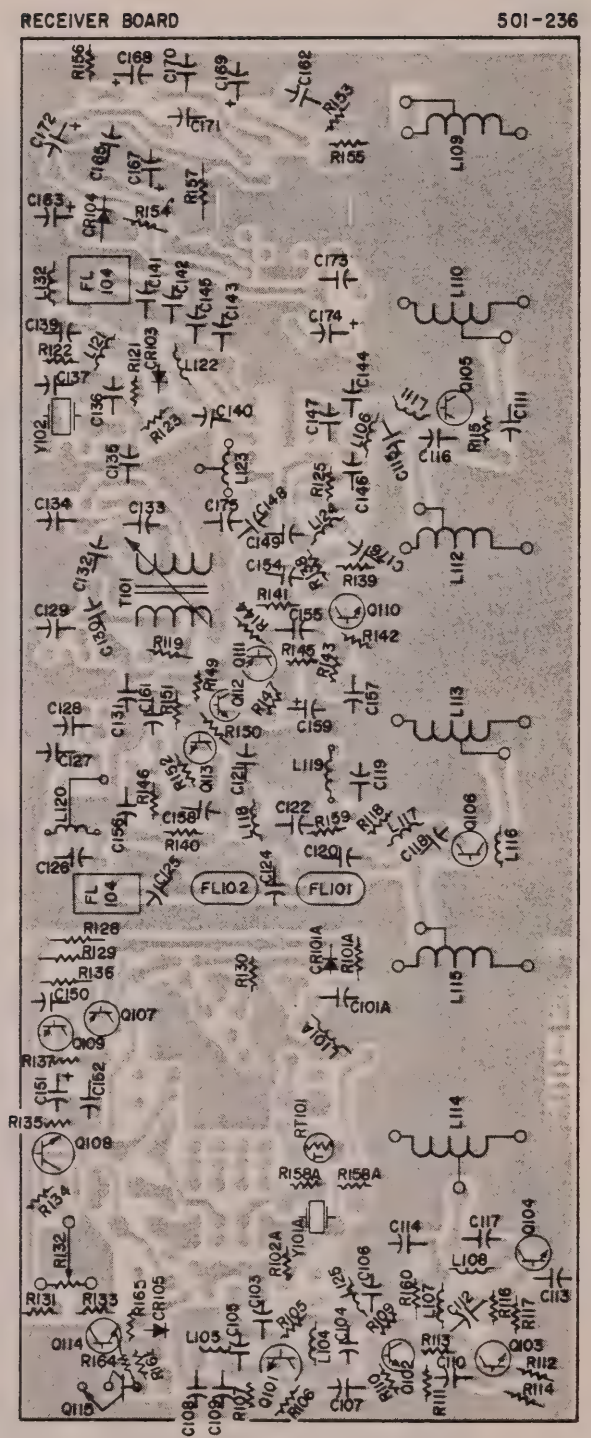
3-5 RECEIVER BOARD BOTTOM VIEW



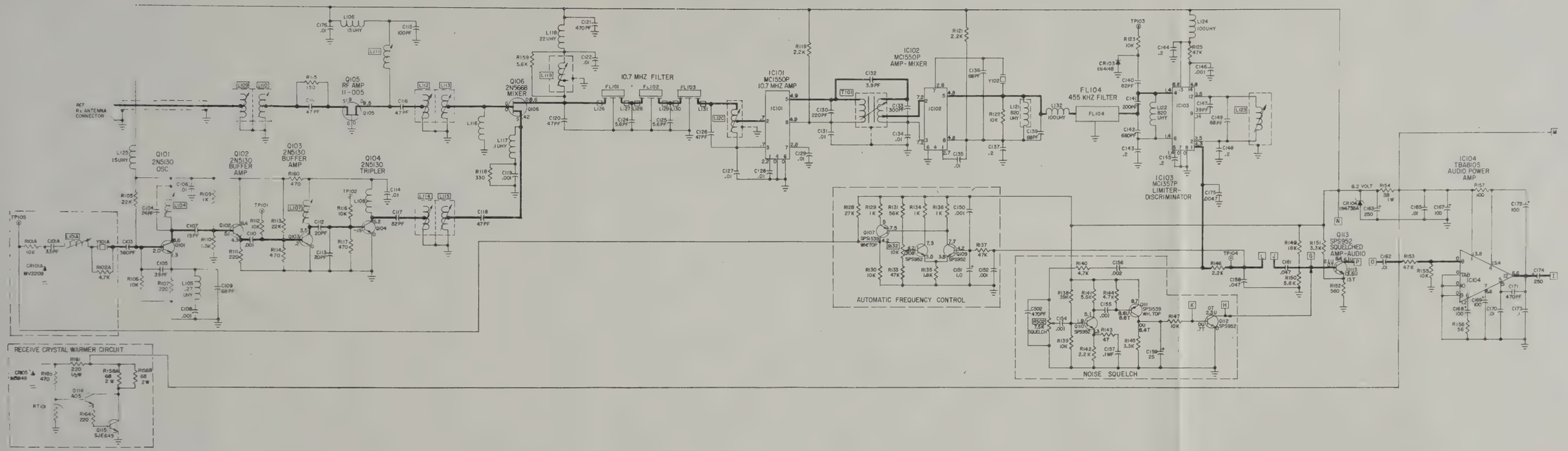
NOTES

1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS. ALL RESISTORS NOT SPECIFIED OTHERWISE ARE ¼ W.
2. ▭ DENOTES ADJUSTABLE COMPONENTS.
3. ◻ DENOTES CIRCUIT JUNCTION POINTS.
4. HEAVY LINE DENOTES APPARENT SIGNAL FLOW
5. ALL VOLTAGES ARE NOMINAL VALUES AS MEASURED WITH A VTVM, SUPPLY VOLTAGE = 13.8 VDC AT INPUT [M]
   LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
   - u = UNSQUELCHED
   - s = SQUELCHED - THRESHOLD
   - t = SQUELCHED - TIGHT

3-6 RECEIVER SCHEMATIC



3-5 RECEIVER BOARD BOTTOM VIEW



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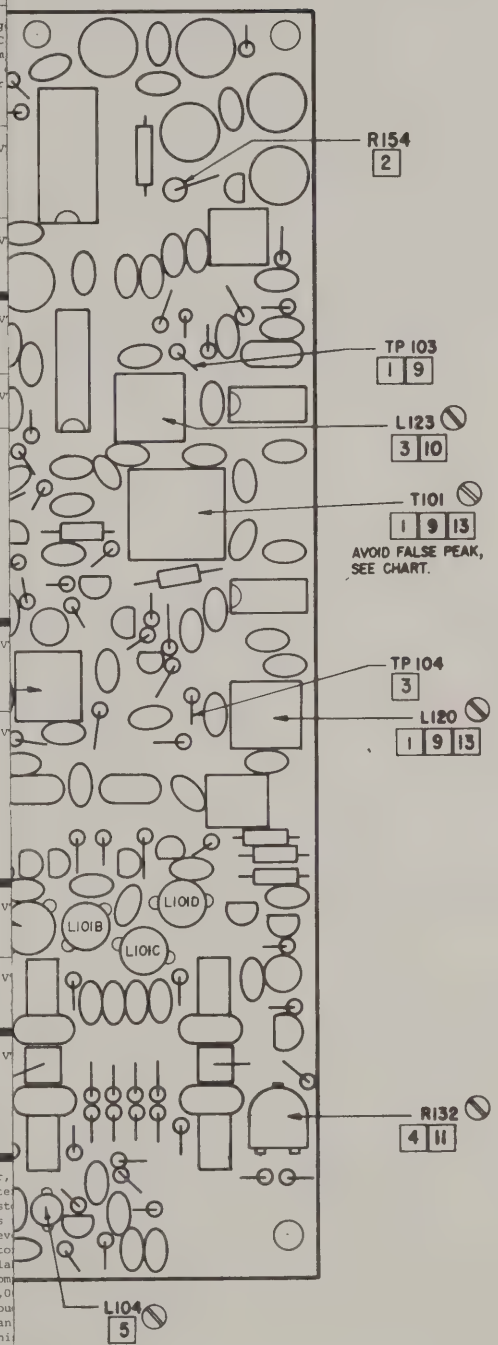
   LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
   u = UNSQUELCHED
   s = SQUELCHED - THRESHOLD
   t = SQUELCHED - TIGHT

3-6 RECEIVER SCHEMATIC

REC

During the receiver alignment procedure, set
(i.e., unsquelched). Set volume control to c
cycle tone during the alignment procedure hel

	Signal Source	Observe
Preliminary I.F. alignment. Not necessary if radio has not been badly misaligned.	10.7 MHz Signal Generator, unmodulated. Connect Signal Generator to Drain of Q106, using a series 10,000 ohm resistor.	TP103, using DC V Measure DC voltag of R154, using DC (R154 is a 39 ohm resistor mounted close to the rear chassis) TP104, using DC V TP105, using DC V
	None Required	TP101, using DC V TP102, using DC V
	Signal generator source capable of being set to within ±.00025% of channel frequency. Set signal generator output channel frequency. Modulate generator with a 1000 Hz tone, with ±3 KHz peak modulation deviation. On multiple channel radio, do alignment on channel #1.	TP105, using DC V TP103, using DC V
	Reduce signal generator output to zero signal. If generator attenuator does not permit signal to be reduced below receiver noise level, disconnect signal generator from antenna jack.	TP104, using DC V TP105, using DC V
	Bring signal generator attenuator up to a level that gives a good, quieting, signal. Be sure signal generator is accurately set to channel frequency.	TP105, using DC V
Final touch up for optimum sensitivity	Signal generator, as above, tuned to exact channel frequency, and modulated by a 1000 Hz tone, with peak modulation deviation of 3 KHz.	Distortion meter, to loudspeaker te Follow usual dist meter procedures ting null and lev trols. If a disto ter is not availa step may be accom observing the 1,0 signal on the lou terminals with an loscope, and tuni least noise on th trace. Do NOT att touch up the tuni an unmodulated si tuning for silenc will result in a sponse from the c ter and poor weak performance.
Final discriminator & AFC check	Signal generator, as above, be sure it has not drifted off channel.	

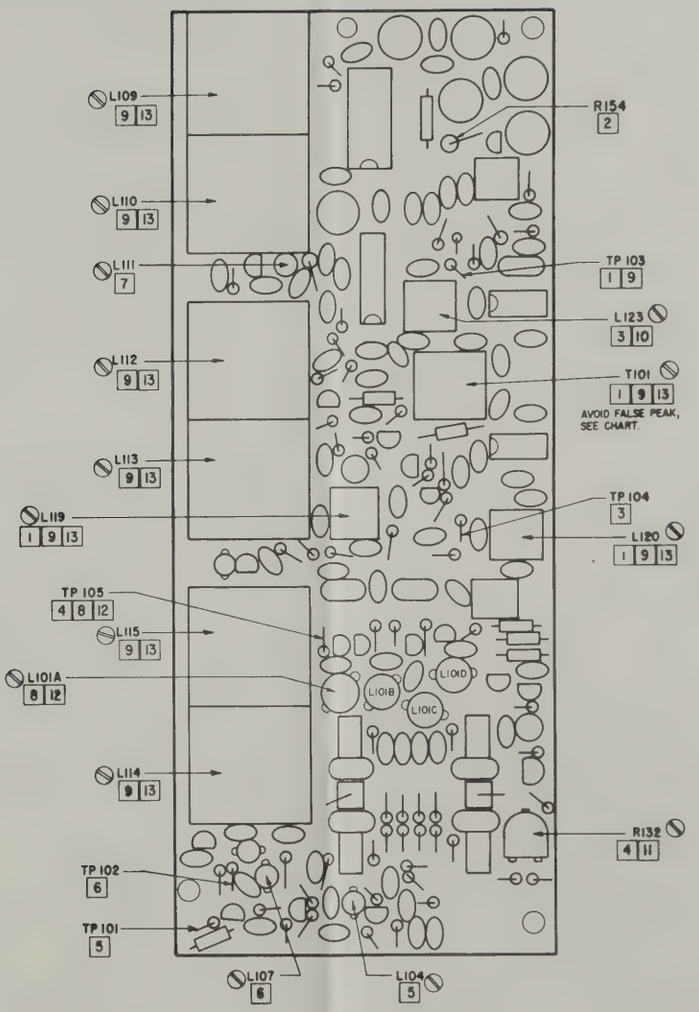


LIGNMENT CHART

RECEIVER ALIGNMENT PROCEDURE

During the receiver alignment procedure, set the squelch control to maximum counter clockwise position, (i.e., unsquelched). Set volume control to comfortable listening level. Listening to received 1,000 cycle tone during the alignment procedure helps to avoid alignment errors.

	Signal Source	Observe	Adjust	Expected Reading, Notes
Preliminary I.F. alignment. Not necessary if radio has not been badly misaligned.	10.7 MHz Signal Generator, unmodulated. Connect Signal Generator to Drain of Q106, using a series 10,000 ohm resistor.	TP103, using DC VTVM	#1 Adjust L119,L120,T101 (top and bottom slugs) for maximum TP103 voltage.	Adjust signal generator output level to obtain a .3 volts positive reading at TP103. As alignment progresses, reduce signal level to maintain the .3 volts reading.
		Measure DC voltage at top of R154, using DC VTVM. (R154 is a 39 ohm, 2 watt resistor mounted on end, close to the rear of the chassis)	#2 No adjustments in this step.	Measured voltage should be close to 8.2 volts. From this measurement, determine proper discriminator set voltage. Discriminator set voltage will be 1/2 of voltage at top of R154.
		TP104, using DC VTVM	#3 Adjust L123 to obtain the proper discriminator set voltage as determined by Step 2.	This is a discriminator adjustment. TP104 voltage should swing through the discriminator set voltage determined in Step 2.
		TP105, using DC VTVM	#4 Adjust R132 to obtain +4.0 volts reading at TP105.	This adjusts output of AFC amplifier to be at +4.0 volts when receiving an on-channel signal.
	None Required	TP101, using DC VTVM	#5 Tune L104 for minimum positive or maximum negative reading on TP101.	0 to +.2 volts. +.3 volts indicates oscillator is not oscillating.
		TP102, using DC VTVM	#6 Tune L107 for maximum negative reading on TP102.	-.. to -.4 volts.
			#7 If the channel frequency is below 467 MHz, set the aluminum core on L111 even with the top of the coil form. If the channel frequency is above 467 MHz, set the aluminum core on L111 all the way to the bottom of the coil form. Once set, it is not necessary to adjust L111 during the tuning procedure.	
	Signal generator source capable of being set to within +.00025% of channel frequency. Set signal generator output channel frequency. Modulate generator with a 1000 Hz tone, with +3 KHz peak modulation deviation. On multiple channel radio, do alignment on channel #1.	TP105, using DC VTVM	#8 Adjust L101A to obtain +4.0 volts reading on TP105.	This is the receiver frequency adjustment. TP105 reading should swing through the 4.0 volts setting as L101 is adjusted.
		TP101, using DC VTVM	#9 Adjust L109,L110,L112,L113, L114,L115,L119,L120, and T101 top and bottom slugs for maximum reading at TP101.	As alignment progresses, reduce signal generator output level to maintain about .3 volts output at TP103. Caution: It is possible to tune the slugs on T101 to a false peak. Correct peak is the one with both top and bottom slugs furthest out from the center of the transformer.
	Reduce signal generator output to zero signal. If generator attenuator does not permit signal to be reduced below receiver noise level, disconnect signal generator from antenna jack.	TP104, using DC VTVM	#10 Adjust L123 to obtain proper discriminator set voltage as determined in Step 2.	This adjusts discriminator to center of receiver bandpass.
		TP105, using DC VTVM	#11 Adjust R132 to obtain +4.0 volts reading at TP105.	This adjusts AFC voltage to center value when no signal received.
	Bring signal generator attenuator up to a level that gives a good, quieting, signal. Be sure signal generator is accurately set to channel frequency.	TP105, using DC VTVM	#12 Adjust L101A to obtain +4.0 volts reading on TP105. On multiple channel receivers, repeat this in channels 2,3, and 4, adjusting L101B,C, and D respectively.	This adjusts receiver local oscillator chain to proper center frequency.
Final touch up for optimum sensitivity	Signal generator, as above, tuned to exact channel frequency, and modulated by a 1000 Hz tone, with peak modulation deviation of 3 KHz.	Distortion meter, connected to loudspeaker terminals. Follow usual distortion meter procedures for setting null and level controls. If a distortion meter is not available, this step may be accomplished by observing the 1,000 cycle signal on the loudspeaker terminals with an oscilloscope, and tuning for least noise on the sine wave trace. Do NOT attempt to touch up the tuning by using an unmodulated signal and tuning for silencing; this will result in a peaked response from the crystal filter and poor weak signal performance.	#13 Adjust L109,L110,L112,L113, L114,L115,L119,L120,T101, (top and bottom).	During this procedure keep signal level from the signal generator at a value sufficient to obtain a -12 db(25%) reading on the distortion meter. Remember that this is a "touch up" type of adjustment. None of the adjustments should be moved more than a small amount from the setting previously obtained.
Final discriminator & AFC check	Signal generator, as above, be sure it has not drifted off channel.		#14 Repeat steps 3 and 4 with zero signal input. Repeat step 12 on each channel with a strong signal.	



3-7 RECEIVER ALIGNMENT CHART

SECTION 4
TRANSMITTER

SECTION 4 TRANSMITTER

4-1 TRANSMITTER CIRCUIT DESCRIPTION

AUDIO SECTION

Integrated Circuit IC201 (sections A and B) constitutes the audio circuitry of the transmitter. IC201A provides a high impedance input for the ceramic microphone, and supplies pre-emphasis and amplification prior to the modulation limiting circuit which consists of CR210 and CR211. IC201B provides additional amplification, and acts as an active filter to provide the post-limiter filter action. The output of IC201B is fed to a control potentiometer which controls the audio voltage sent to the modulator section and, therefore, is used to set the peak modulation deviation of the transmitter.

IC201B also provides an amplified input to feed tones for continuous tone squelch systems, or other tone systems, into the transmitter modulation circuits.

CRYSTAL OSCILLATOR

Y201 serves as the crystal oscillator, using a crystal at 1/36 of the channel frequency. The crystal is a fundamental cut, in the frequency range 12.5 to 14.3 MHz.

Direct frequency modulation of the crystal is obtained by applying the modulation signals from the audio section to varactor modulator diode, CR201A.

FREQUENCY MULTIPLIER SYSTEM

The output of the crystal oscillator, Q201, is tuned to three times the crystal frequency, and this signal is amplified by buffer-amplifier Q202, then delivered to the tripler circuit, Q203, then delivered to the doubler circuit Q204. Q204 drives another doubler, Q205, to obtain a combined frequency multiplication of 36 to reach the channel frequencies from 450-470 MHz. The doubler Q205 developes about 150 milliwatts of power to drive the power output module IC501.

POWER OUTPUT SECTION

The packaged power output module, IC501, contains three cascaded stages of power amplification. Its gain, and therefore its power output, can be controlled over certain limits by the power

control circuit consisting of R227 and Q206, which varies the DC voltage input to one of the early amplifier stages. In normal operation, R227 is adjusted to provide the rated output from the transmitter, but it can be set for reduced power operation for special applications. In order to protect the power module from possible damage through overheating, a thermal protection circuit is included. RT201 is a thermistor that rapidly increases in resistance as its temperature reaches certain levels. RT201 is attached to one of the mounting bolts on IC501. When the temperature approaches excessive levels, RT201 increases in resistance, thereby reducing the voltage supplied to IC501 by the power control circuit.

4-2 TRANSMITTER VOLTAGES

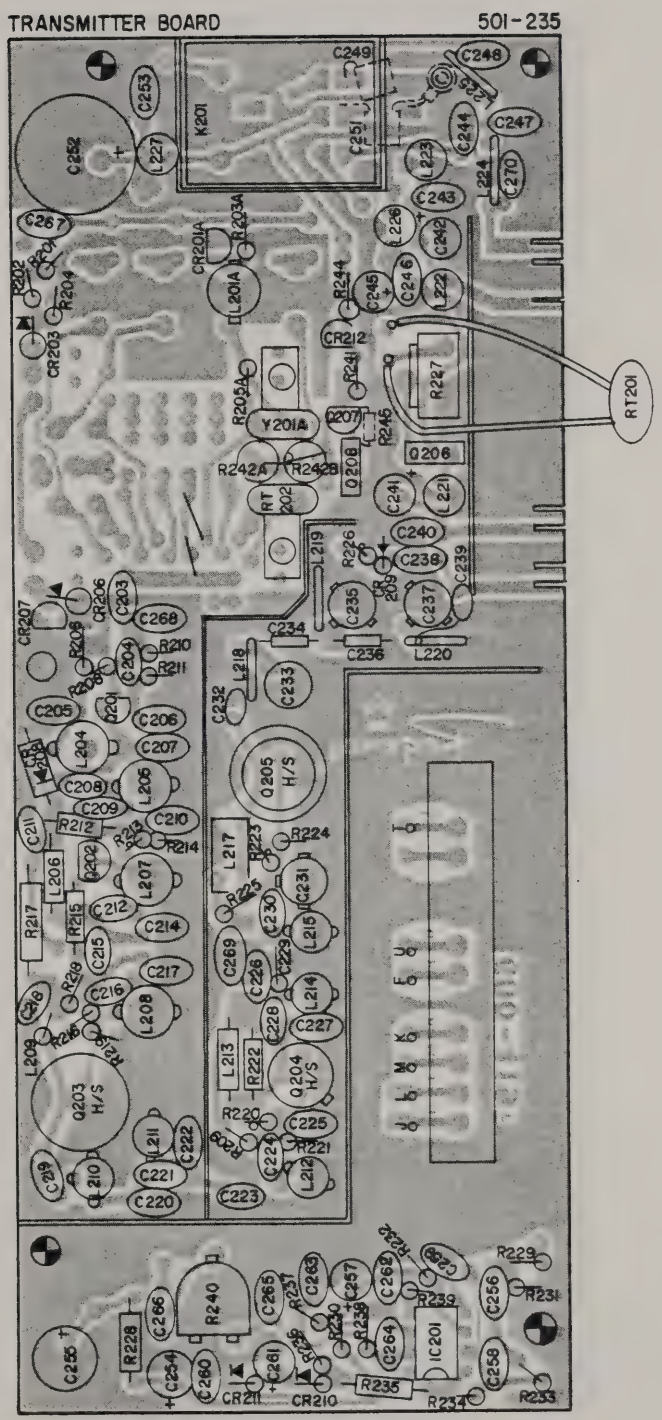
Transmitter Transistors:

	Emitter	Base	Collector
Q201	3.0	2.0	8.2
Q202	0	0.55	6.0
Q203	0	0.34	10.0
Q204	0	0.05	12.0
Q205	0	-0.62	13.8
Q206 (PNP)	7.0	7.4	11.0
Q207	0.4	0.8	13.0 @ 25°C
Q208	0	0.4	13.0 @ 25°C

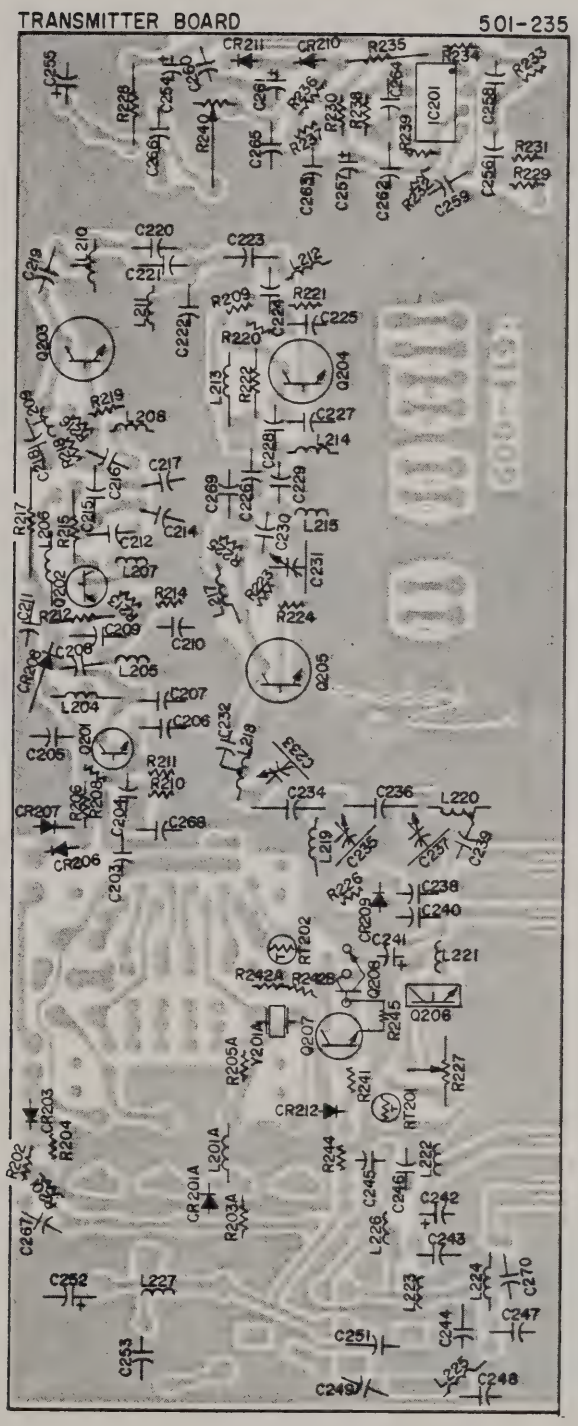
Transmitter Integrated Circuits:

IC No.	1	2	3	4	5	6	7	8
IC201	4.0	4.0	4.0	0	4.0	4.0	4.0	8.2
IC501	0	0	13.8	0	6.6	0	-0.1	-

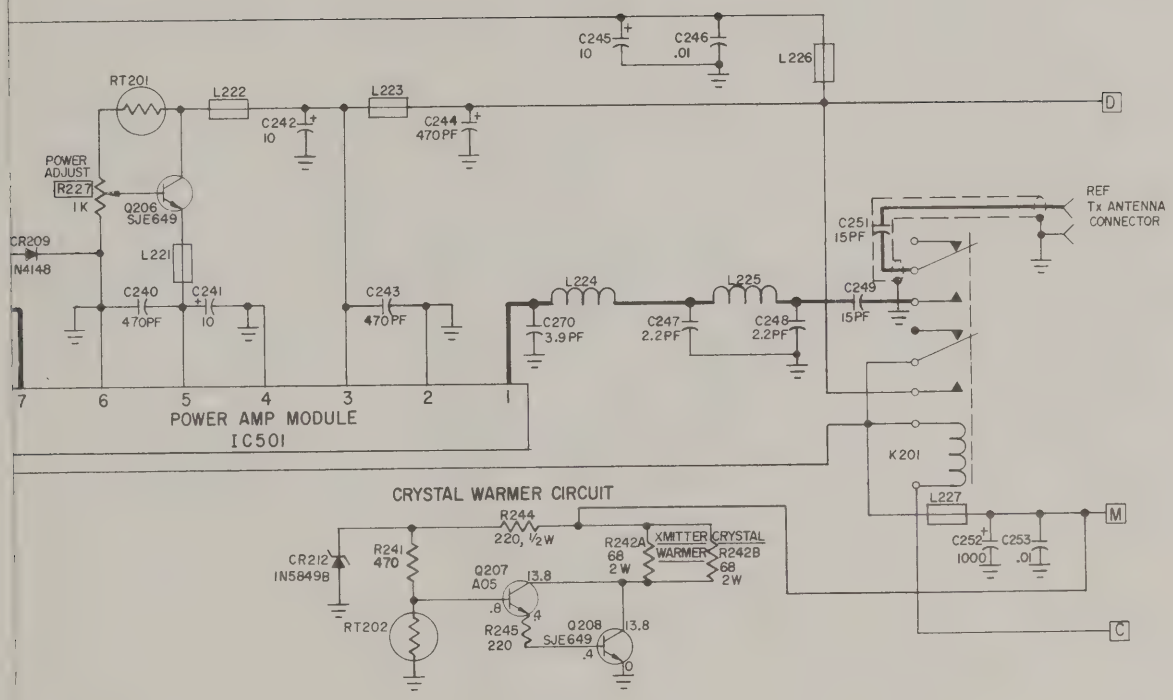
4-3 TRANSMITTER BLOCK DIAGRAM



4-4 TRANSMITTER BOARD TOP VIEW



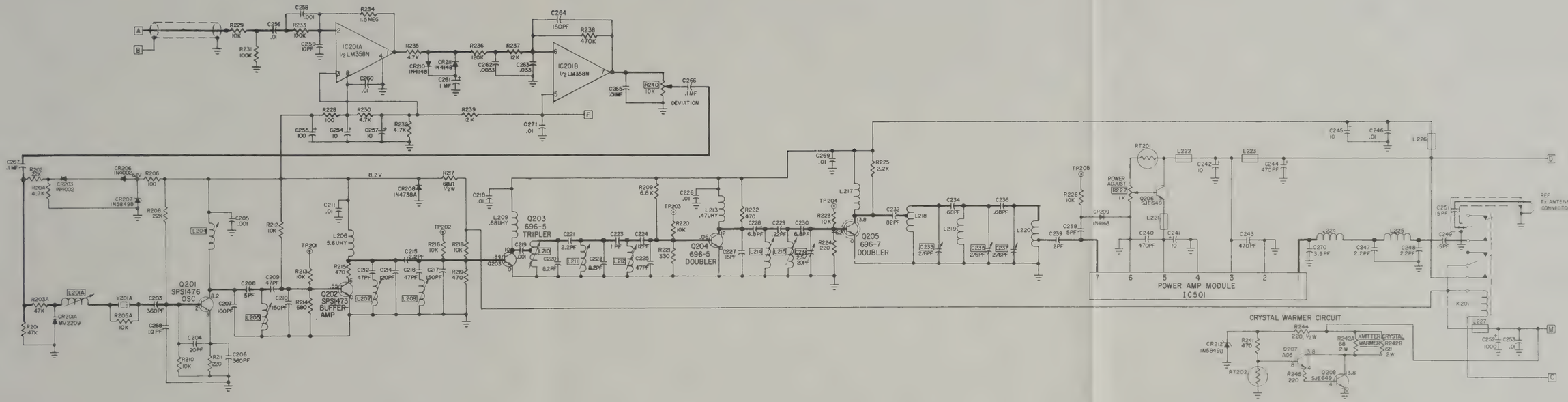
4-5 TRANSMITTER BOARD BOTTOM VIEW



NOTES

1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 W.
2. ▭ DENOTES ADJUSTABLE COMPONENTS.
3. □ DENOTES CIRCUIT JUNCTION POINTS.
4. HEAVY LINES DENOTES APPARENT SIGNAL FLOW.
5. ALL VOLTAGES ARE NOMINAL VALUES AS MEASURED WITH A VTVM, SUPPLY VOLTAGE = 13.8 V D.C. AT INPUT TO [M] VOLTAGES INDICATED ARE MEASURED WITH TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

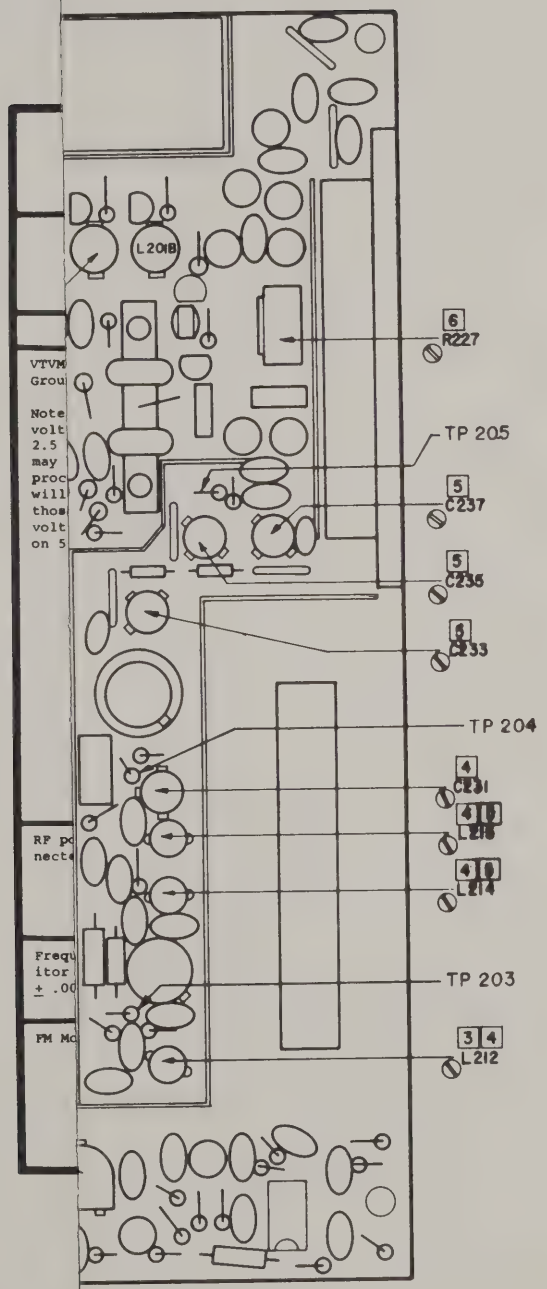
4-6 TRANSMITTER SCHEMATIC



NOTES

1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ALL RESISTORS NOT SPECIFIED OTHERWISE ARE ¼ W.
2. ⟋ DENOTES ADJUSTABLE COMPONENTS.
3. □ DENOTES CIRCUIT JUNCTION POINTS.
4. HEAVY LINES DENOTES APPARENT SIGNAL FLOW
5. ALL VOLTAGES ARE NOMINAL VALUES AS MEASURED WITH A VTVM, SUPPLY VOLTAGE = 13.8 V DC AT INPUT TO [M]. VOLTAGES INDICATED ARE MEASURED WITH TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-6 TRANSMITTER SCHEMATIC



TTER TUNING CHART

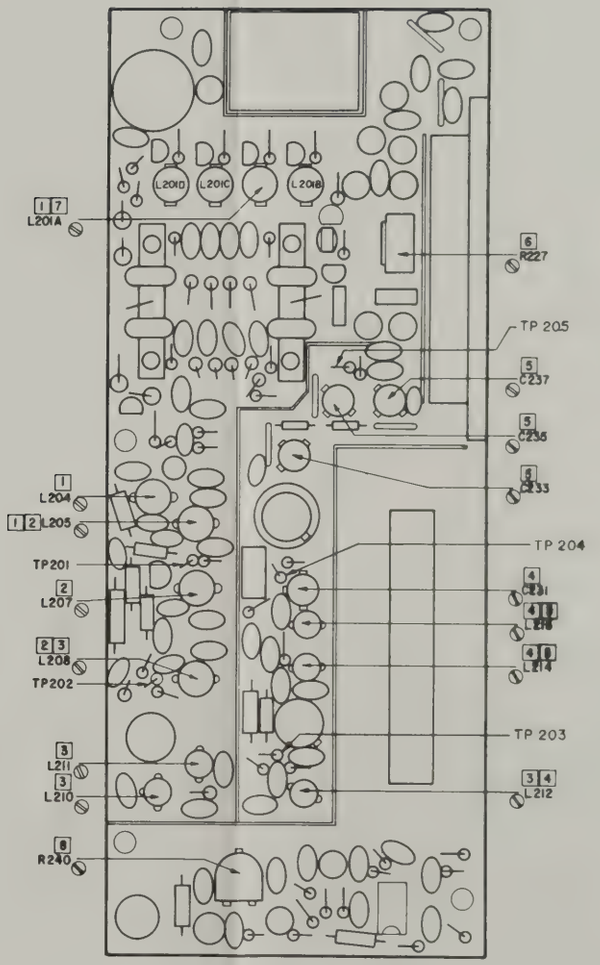
TRANSMITTER TUNING

During Tune-Up Procedure, press the microphone button only when actually taking readings or making tuning adjustments. Until tune-up is completed, keep transmitter on time to a minimum.

Connect a 50 ohm load and R.F. wattmeter to the antenna terminal.

On multiple channel transmitters, conduct first tuning on highest frequency channel.

Test Meter	Observe		Adjust	Expected Reading
VTVM Ground lead on chassis Note: a 20,000 ohm per volt multimeter, on the 2.5 or 5 volts scale may be used for these proceedings. Readings will be 20% lower than those given here on 2.5 volt scale, and 10% lower on 5 volt scale.	TP201	#1	L201, and L205. L204 for minimum positive voltage reading (or maximum negative if TP2 goes negative).	+.55 volts, no drive +.4 to -.3 volts normal. A false peak on L205 is possible, look for biggest one.
	TP202	#2	L207 and L208 for minimum positive (or maximum negative) voltage reading. Then touch up L205 for maximum negative voltage reading.	+.5 volts, no drive +.25 to -.3 volts normal.
	TP203	#3	L210, L211, L212 for negative voltage reading. Then touch up L208 for maximum negative reading.	0 volts, no drive -.1 to -.4 volts normal.
	TP204	#4	L214, L215 and C231 for maximum negative reading. Then touch up L212 for maximum negative reading.	0 volts, no drive -.7 to -.9 volts normal.
	TP205	#5	C233, C235, C237 for maximum negative reading. Then touch up L214, L215, C235 for maximum negative reading.	0 volts, no drive -3 to -5 volts normal.
RF power meter, connected to antenna jack.	RF power output	#6	R227 to 10 watts output	10 watts normal.
	In multiple channel transmitters, if spacing between highest and lowest channel exceeds 3 MHz go back through all but the first step and tune for a compromise adjustment between the highest and lowest channel.			
Frequency meter, FM monitor or counter, with ± .00025% accuracy.	#7	Switch to channel #1 and adjust L201A to exact channel frequency. Then switch to channels 2,3, and 4, and adjust L201B, L201C, and L201D respectively to exact channel frequency. If either L201A,B,C,D have been changed appreciably during this step, go back and repeat the frequency setting on all channels.		
FM Modulation Monitor	#8	Inject a 100 millivolt (.1 volt) tone at 1,000 Hz into the microphone jack (pin #4 high, pin #1 ground), and adjust R240 so modulation deviation just reaches ± 5 KHz peak. Then, in CTCSS units, remove the 1,000 Hz tone and adjust R605 on the CTCSS board to obtain ±.75 KHz peak modulation deviation on the CTCSS tone. Reinsert the 1,000 Hz tone and adjust R240, so combined modulation peak deviation of the 1,000 Hz tone and the CTCSS tone is ± 5 KHz peak. If R240 was changed much, recheck the deviation due to the CTCSS tone alone, to be sure you still have .75 KHz peak deviation on CTCSS tone.		



4-7 TRANSMITTER TUNING CHART

SECTION 5

POWER SUPPLY

SECTION 5 POWER SUPPLY

5-1 REGULATED POWER SUPPLY CIRCUIT DESCRIPTION

The circuit diagram of the power supply is shown as a part of the overall repeater schematic, in Section 7.

The power supply transformer T501 transforms the 117 VAC line voltage to 38 VAC, center tapped, at the secondary. Rectifiers CR501, CR502, CR503, CR504 and filter capacitor C503, rectify and filter this secondary voltage to produce approximately 23 VDC which is reduced to 13.0 VDC by the series-pass regulator transistor Q501. CR501, CR502, and C502 provide a separate 23 VDC supply for the Regulator Board Circuitry.

The regulator circuitry operates as follows:

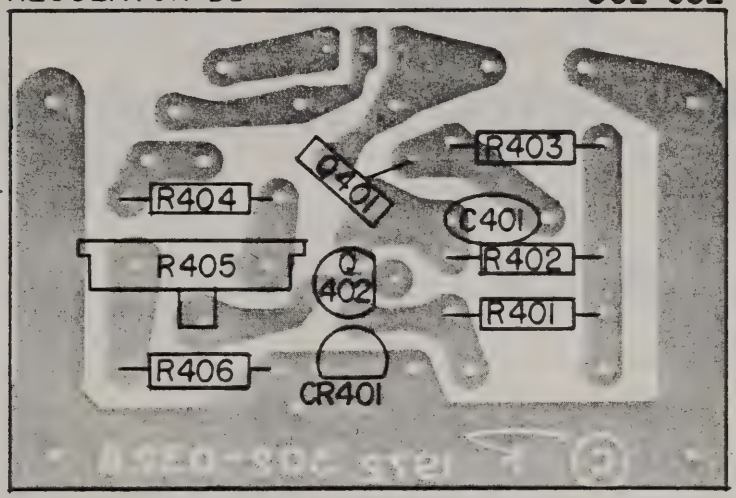
R404, R405, and R406 divide Q501's output (emitter) voltage down to a sample voltage slightly higher than that of CR401. Q402 continuously compares this sample voltage with the reference voltage of CR401 and adjusts the drive through amplifier Q401 to the regulator transistor Q501 accordingly.

As an example, assume that the radio set (load) increases the current drain on Q501, causing the output voltage, and consequently the sample voltage, to drop slightly. The reduction of base-emitter voltage of Q402 would cause a slight decrease in collector current which in turn would increase drive to Q401 (through R402). Q401 would then increase the base current to Q501 causing it to supply more current to the load and raise the output voltage slightly. In this manner an equilibrium is reached. Potentiometer R405 allows adjustment of the output voltage which is normally set for 13.0 VDC under Receive (standby) conditions.

5-2 POWER SUPPLY VOLTAGES

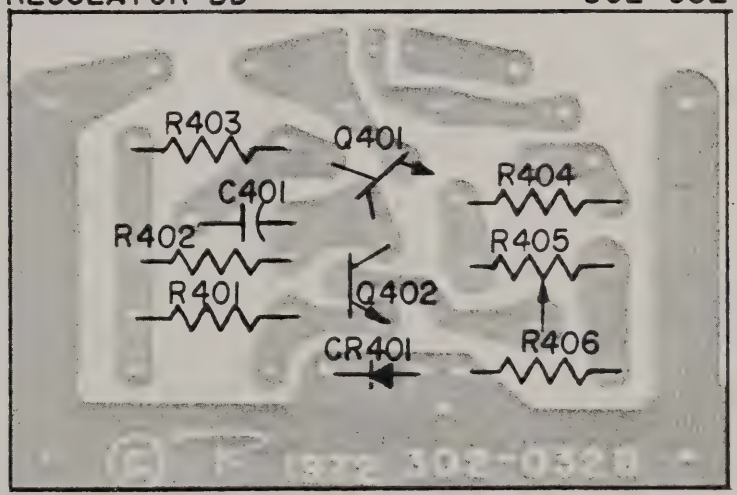
	Emitter	Base	Collector
Q401	13.8	15.6	23
Q402	6	6.5	15.6
Q501	13	13.8	23

REGULATOR BD 302-032



TOP VIEW

REGULATOR BD 302-032



BOTTOM VIEW

FIG. 5-3

SECTION 6

MA-90 TONE ENCODER-DECODER, & MA-95 ENCODER

SECTION 6 MA-90 TONE ENCODER-DECODER, AND MA-95 TONE ENCODER

6-1 GENERAL INFORMATION

The model MA-90 Tone Squelch Encoder-Decoder is used as a tone decoder for CTCSS (tone squelch) operation of the Regency MICRO-COM U10R repeater. Since the MA-90 can serve as either an encoder or a decoder, it can be used in either the encoder or decoder sockets of the U10R repeater.

The model MA-95 Tone Squelch Encoder is a simplified version of the MA-90 encoder-decoder, in which only those components needed for the encoding function are installed.

Normally, for each tone frequency accommodated by the MICRO-COM U10R repeater, one MA-90 is installed in a decoder position and one MA-95 is installed in an encode position.

6-2 MA-90 CIRCUIT DESCRIPTION (TONE DECODING CONDITION)

Refer to the Circuit Diagram, Figure 6-4. When point "D" is grounded, the module is in the decoding mode.

Audio from the receiver discriminator is fed into the tone squelch board at terminal L, and passes through the High Pass Filter IC601, and back to the receiver's audio amplifier circuits at terminal J. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (at L) is also fed into IC602, which contains a low pass filter, and a limiter amplifier. The low pass filter removes most of the speech and higher frequency noise components from the signal, leaving essentially only the CTCSS tone frequencies and low frequency noise components. This filtered signal is then passed to the combination of IC603 and IC604, which acts as a high Q band pass filter, tuned sharply to the wanted CTCSS tone. IC603 contains the tone determining portions of the combination, and IC604 contains the necessary amplifiers for the filter arrangement. If the received tone is the proper one, as determined by IC603, it will be present in the output of the IC603--IC604 combination. This tone then passes to IC605, which is a detector circuit that detects the presence (or absence) of a tone signal.

The IC605 output, is normally high, and goes to a low voltage upon receipt of tone. This output appears at terminal K to signify

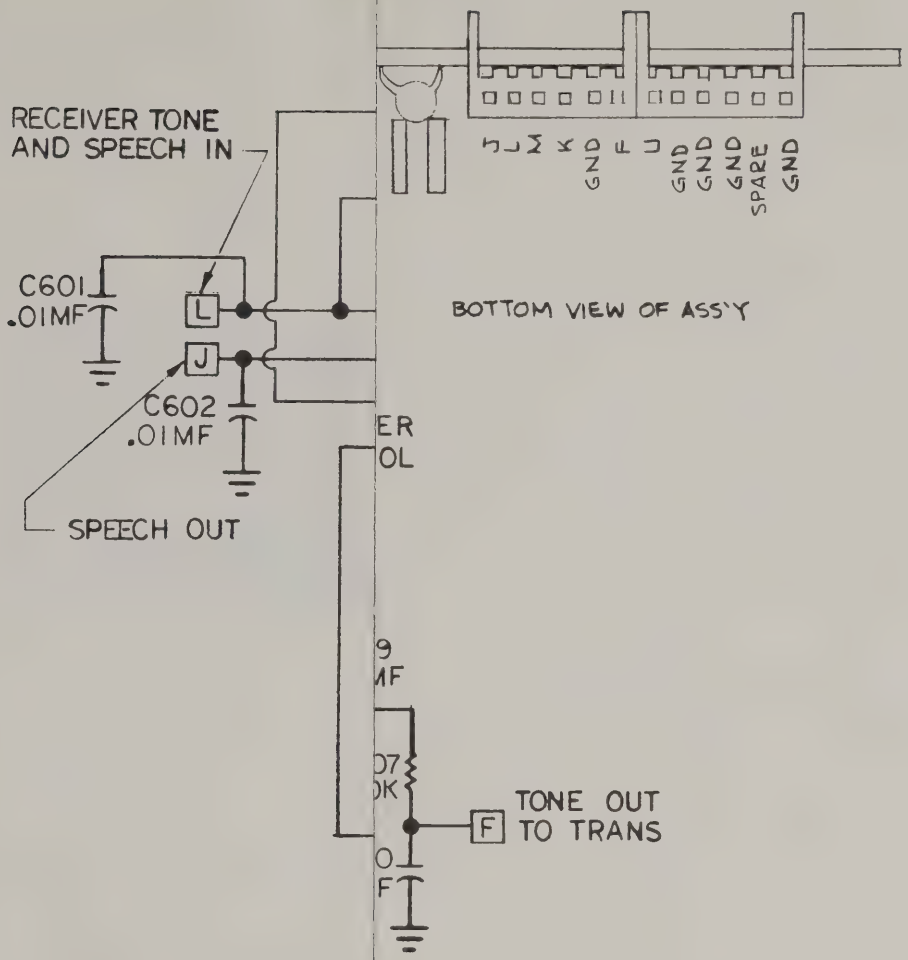
the receipt of a signal having the designated tone squelch frequency.

6-3 CIRCUIT DESCRIPTION, MA-95 ENCODER

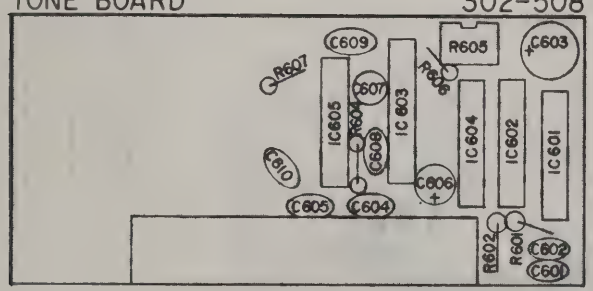
The MA-95 is an encode only version of the MA-90. Refer to the circuit diagram, Figure 6-5. The combination of IC603 and IC604 is an oscillator, with the frequency of oscillation being determined by the components in IC603.

The oscillation output of IC603, IC604 is fed to F, and thus to the modulation section of the transmitter.

The amplitude of the tone voltage sent to the transmitter is controlled by R605, which is the control for adjusting the amount of modulation deviation caused by the tone.



TONE BOARD 302-508



NOT SPECIFIED OTHERWISE ARE

NOT SPECIFIED OTHERWISE ARE

215 FOR BASIC RADIO SCHEMATIC.
ONNECTION POINTS TO

ENCODER-DECODER BOARD

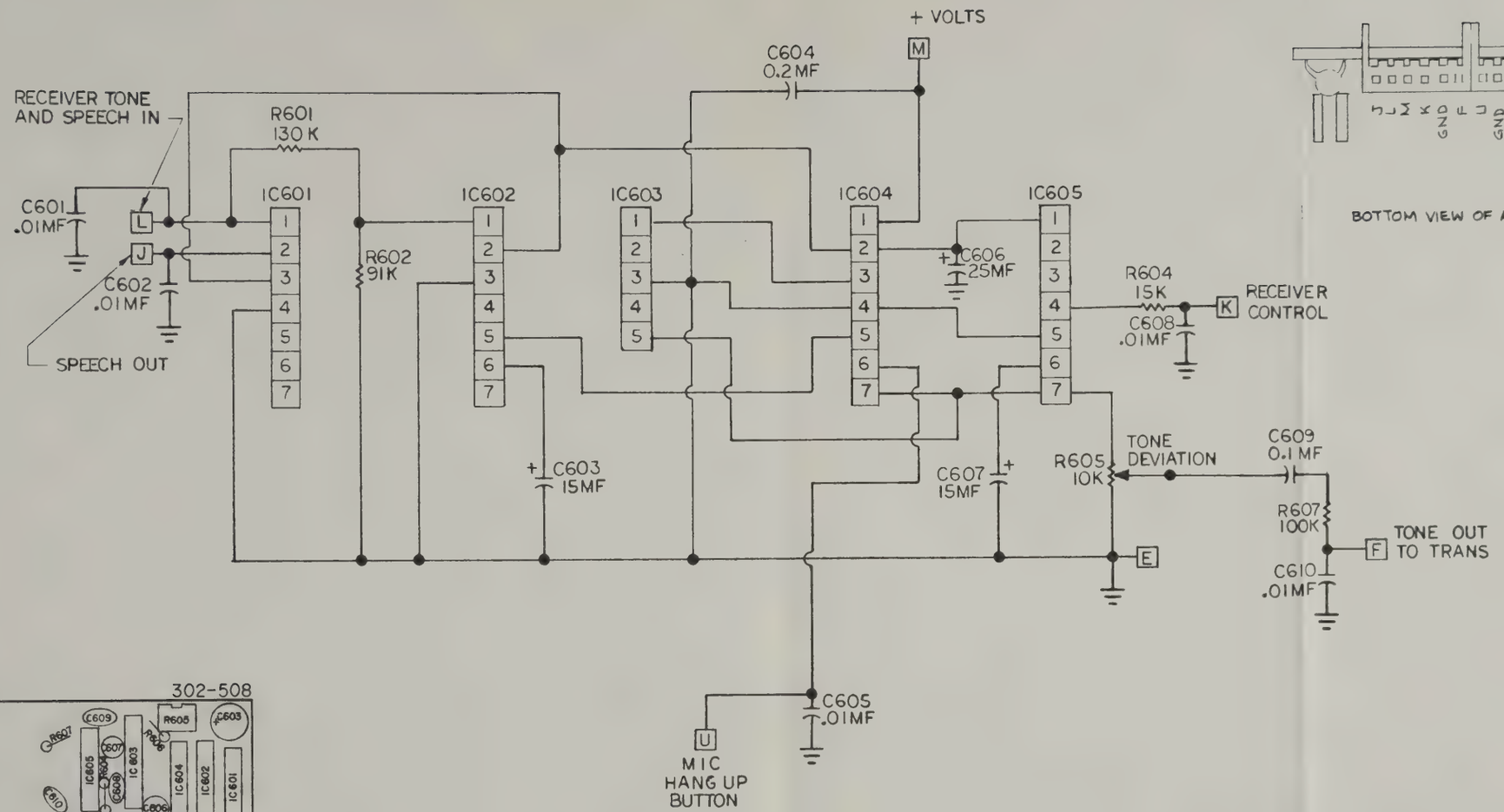
the receipt of a signal having the designated tone squelch frequency.

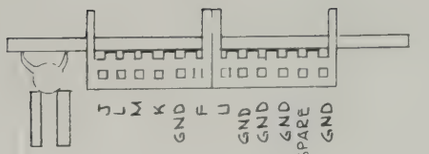
6-3 CIRCUIT DESCRIPTION, MA-95 ENCODER

The MA-95 is an encode only version of the MA-90. Refer to the circuit diagram, Figure 6-5. The combination of IC603 and IC604 is an oscillator, with the frequency of oscillation being determined by the components in IC603.

The oscillation output of IC603, IC604 is fed to F, and thus to the modulation section of the transmitter.

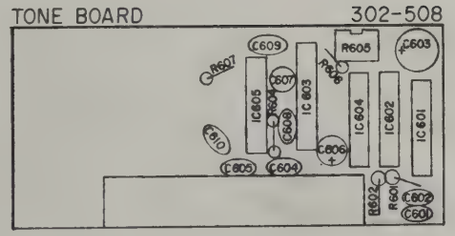
The amplitude of the tone voltage sent to the transmitter is controlled by R605, which is the control for adjusting the amount of modulation deviation caused by the tone.



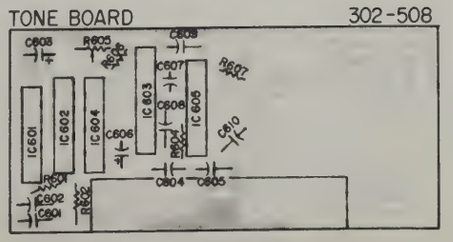


BOTTOM VIEW OF ASS'Y

TONE BOARD 302-508



TONE BOARD 302-508

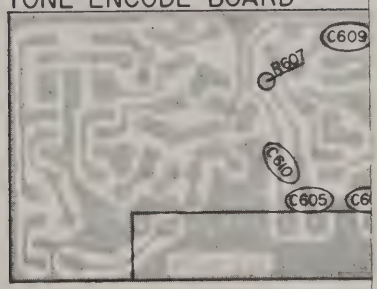


NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO FARADS.
   ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS.
2. REFER TO DRAWING 700-215 FOR BASIC RADIO SCHEMATIC.
3. LETTERED BOXES ARE CONNECTION POINTS TO DRAWING 700-215

6-4 MA-90 TONE ENCODER-DECODER BOARD

TONE ENCODE BOARD



ONE
EVIATION

C609
0.1 MF

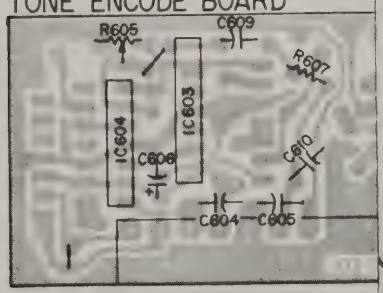
R607
100K

F TONE OUT
TO TRANS

C610
.01MF

L
ECEIVER TONE
ND SPEECH IN

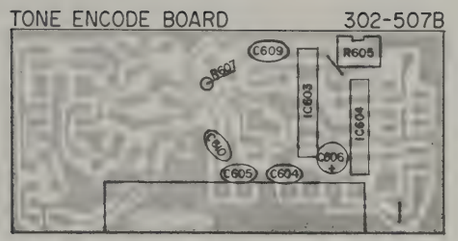
TONE ENCODE BOARD

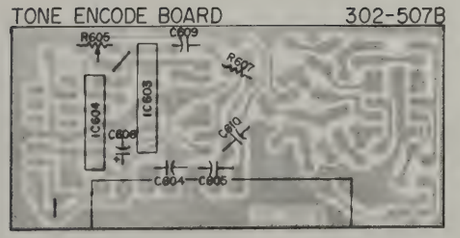


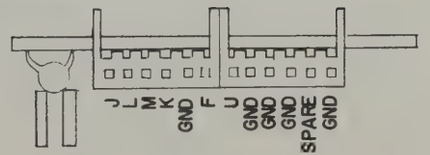
NOT SPECIFIED OTHERWISE

NOT SPECIFIED OTHERWISE

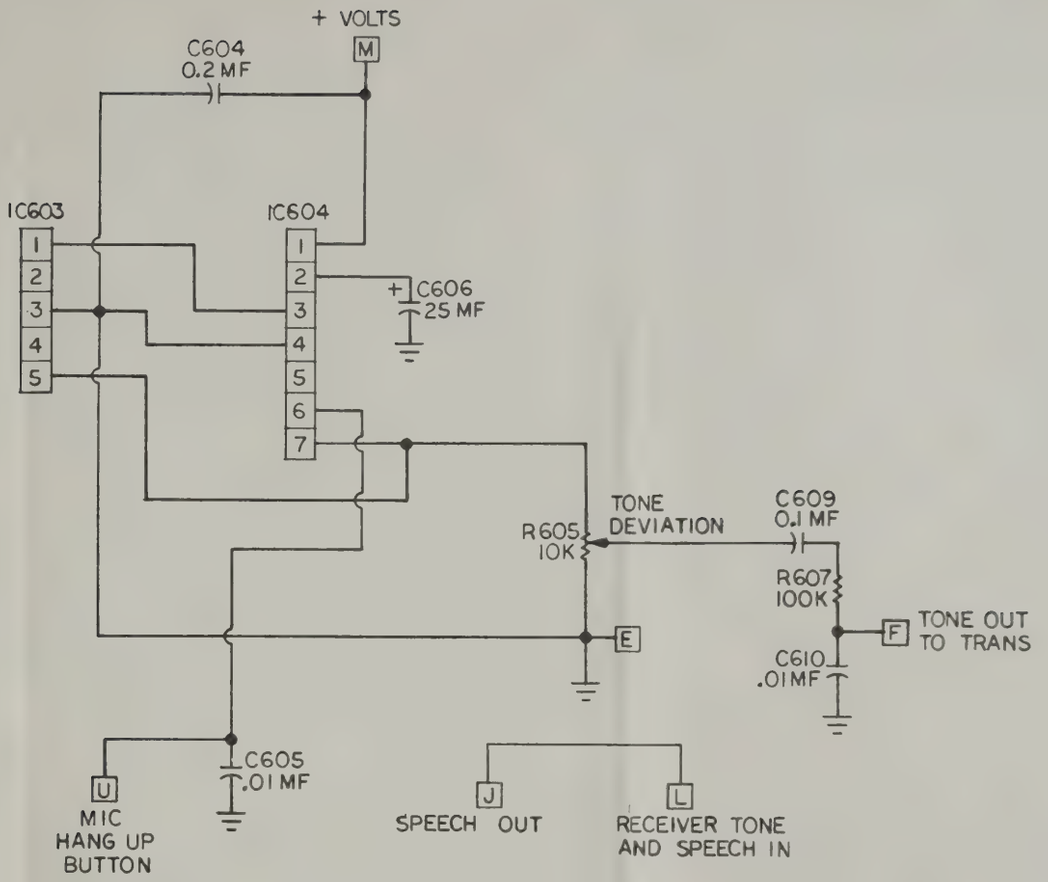
ENCODER BOARD







BOTTOM VIEW OF ASSEMBLY



NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICA FARADS.
   ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS.

6-5 MA-95 TONE ENCODER BOARD

SECTION 6A

MA-116 TONE ENCODER-DECODER

&

MA-121 ENCODER

SECTION 6A MA-116 TONE ENCODER-DECODER, AND MA-121 TONE ENCODER

6A-1 GENERAL INFORMATION

The model MA-116 Tone Squelch Encoder-Decoder is used as a tone decoder for CTCSS (tone squelch) operation of the Regency MICRO-COM U10R repeater. Since the MA-116 can serve as either an encoder or a decoder, it can be used in either the encoder or decoder sockets of the U10R repeater.

The model MA-121 Tone Squelch Encoder is a simplified version of the MA-116 encoder-decoder, in which only those components needed for the encoding function are installed.

Normally, for each tone frequency accommodated by the MICRO-COM U10R repeater, one MA-116 is installed in a decoder position and one MA-121 is installed in an encode position.

6A-2 MA-116 ENCODER-DECODER CIRCUIT DESCRIPTION (Tone Receiving Condition)

Audio from the receiver discriminator is fed into the tone squelch board at terminal L, and passes through the High Pass Filter IC601A, and back to the receiver's audio amplifier circuits at terminal J. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (At L) is also fed into an active filter, consisting of IC601B, IC602A, and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601, and C602.

If the received tone is the proper one, as determined by the bandpass filter, it will be present in the output of IC602 and will be amplified by IC603, and then rectified to a D.C.signal by the tone rectifiers CR601 and CR602. This D.C. signal is then amplified further by the D.C. amplifier, IC603A. The output of IC603 is normally high, and goes to a low voltage upon receipt of proper tone. This output appears at terminal K, which connects to the corresponding terminal K on the receiver chassis, and is used to disable the receiver audio section when no tone is being detected.

6A-3 MA-121 ENCODER CIRCUIT DESCRIPTION

A block diagram of the of the encode only circuit board is shown on Figure 6A-7, and a circuit diagram is shown in Figure 6A-8.

The operating frequency of the tone system is controlled by

an Active filter, consisting of IC601B, IC602A, and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601, and C602.

IC603A is an integrated circuit operational amplifier, used as a limiting amplifier. It is connected between one of the inputs and one of the outputs of the active filter described above. This limiting amplifier thus serves as a feedback path which causes the total circuit to oscillate at a frequency determined by the active filter. The limiting action of IC603 serves to keep the level of oscillation from overloading the active filter, thus keeping the output from the active filter sinusoidal.

6A-4 TONE SETTING INSTRUCTIONS (MA-116 and MA-121)

The tone frequency is determined by (a) the insertion of jumpers to determine which of three bands of operation is desired, and (b) the adjustment of a precision potentiometer to determine the specific tone frequency.

For purposes of installing the jumpers, the total CTCSS frequency is divided into three bands, the low band being 67.0 Hz to 110.9 Hz; the middle band 114.8 Hz to 192.4 Hz, and the high band 203.5 Hz to 253.0 Hz.

INSTALL JUMPERS FOR THE PROPER BAND

Figure 6A-9 shows the jumper locations. Determine which band includes the desired frequency, and insert (or remove) jumpers according to the following chart:

67.0 Hz to 110.9 Hz	Low Band	JU601,JU602,JU603,JU604 are all removed.
114.8 Hz to 192.4 Hz	Middle Band	JU601,JU603 in place. JU602,JU604 removed.
203.5 Hz to 253.0 Hz	High Band	JU602,JU604 in place. JU603,JU605 removed.

After soldering or unsoldering jumpers, at least five minutes should elapse before making any final frequency adjustment. This is necessary to permit the precision resistors and capacitors in the vicinity of the soldering points to stabilize in temperature.

TONE SETTING PRECAUTIONS

Accurate frequency setting is necessary on CTCSS (tone squelch) systems. When making the above frequency adjustments, be sure that you set the tone as precisely as possible. If the tone board is to

operate in a system using reed type tone boards, be sure that your frequency setting is within .1 or .2 Hz if possible. Especially on reed tone systems, it is advisable to measure the tone frequency of several of the existing units; it is not safe to assume that the system is really operating on exactly the frequency stamped on the nameplates.

6A-5 ADJUSTMENT PROCEDURE (Setting Tone Receive Threshold on MA-116)

With the receiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 200 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function,(See Fig. 6A-10).

After performing this adjustment of R612, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 200 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

6A-6 ADJUSTMENT PROCEDURE (Setting Tone Modulation Deviation on MA-121)

Adjust R618, on the tone squelch board to obtain a tone modulation deviation of plus and minus 500 Hz. Then, insert a 100 millivolt, 1,000 Hz tone into pin four of the microphone jack, and adjust R240, (the transmitter deviation control on the transceiver) to obtain plus and minus 5 KHz peak modulation deviation. If R240 was changed much, remove the 1,000 Hz tone, and readjust R618 to obtain a tone squelch modulation deviation of plus and minus 500 Hz.

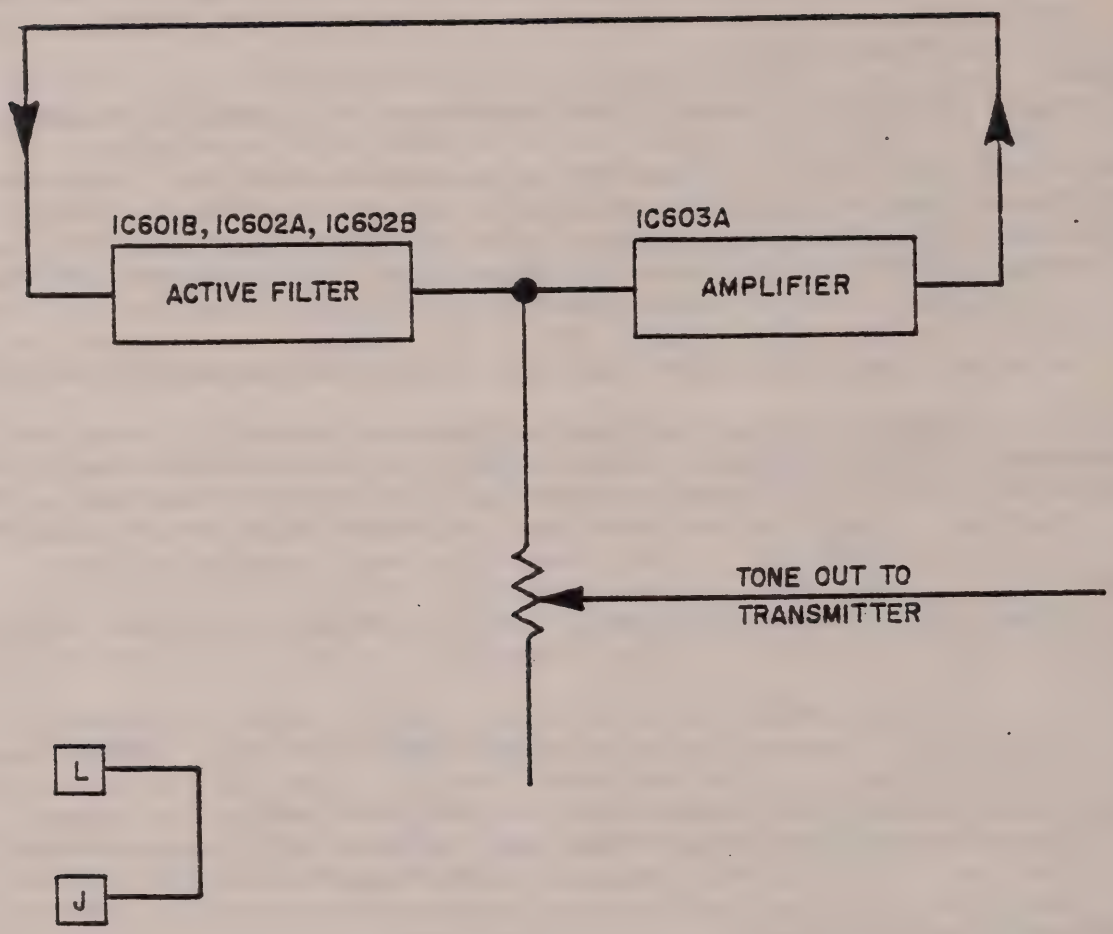


FIG 6A-7 BLOCK DIAGRAM

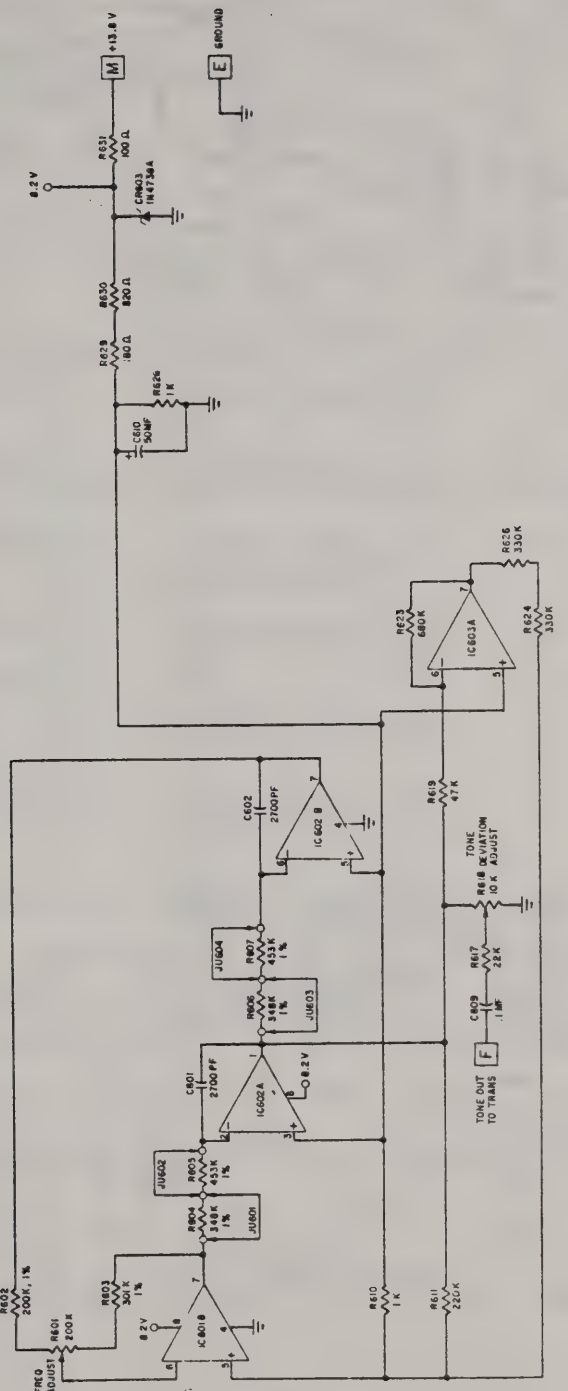
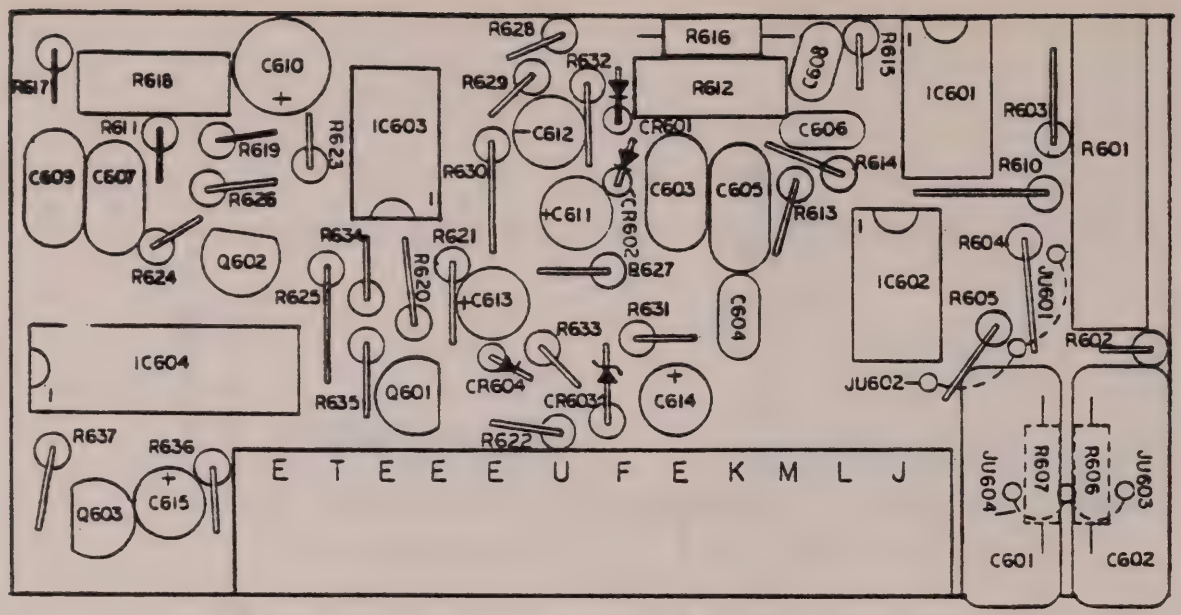
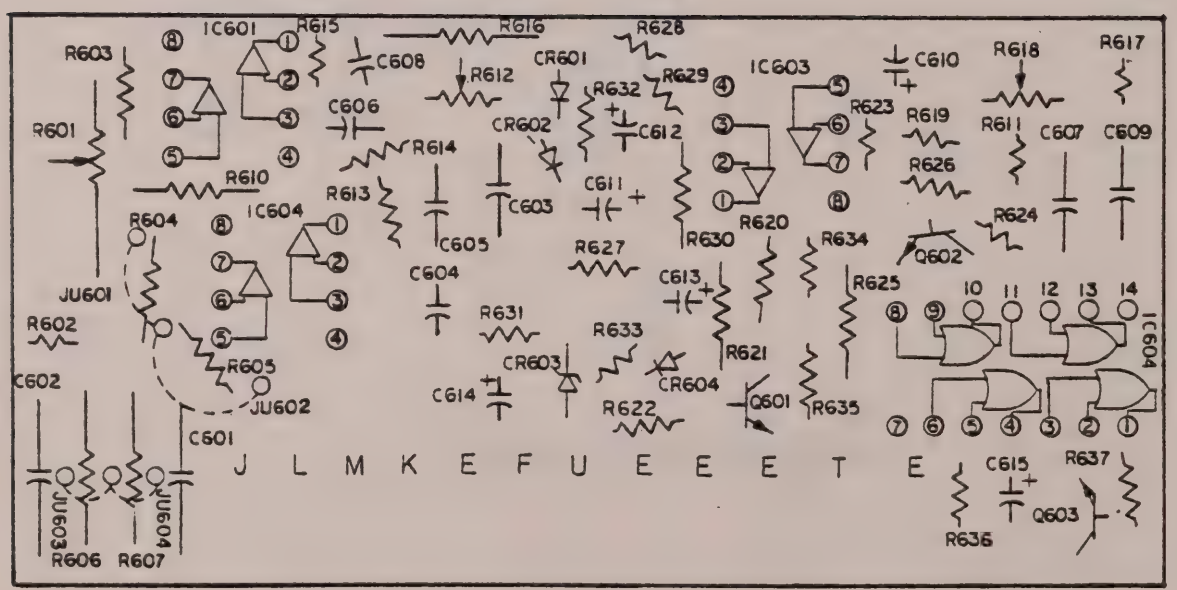


FIG 6A-8 SCHEMATIC

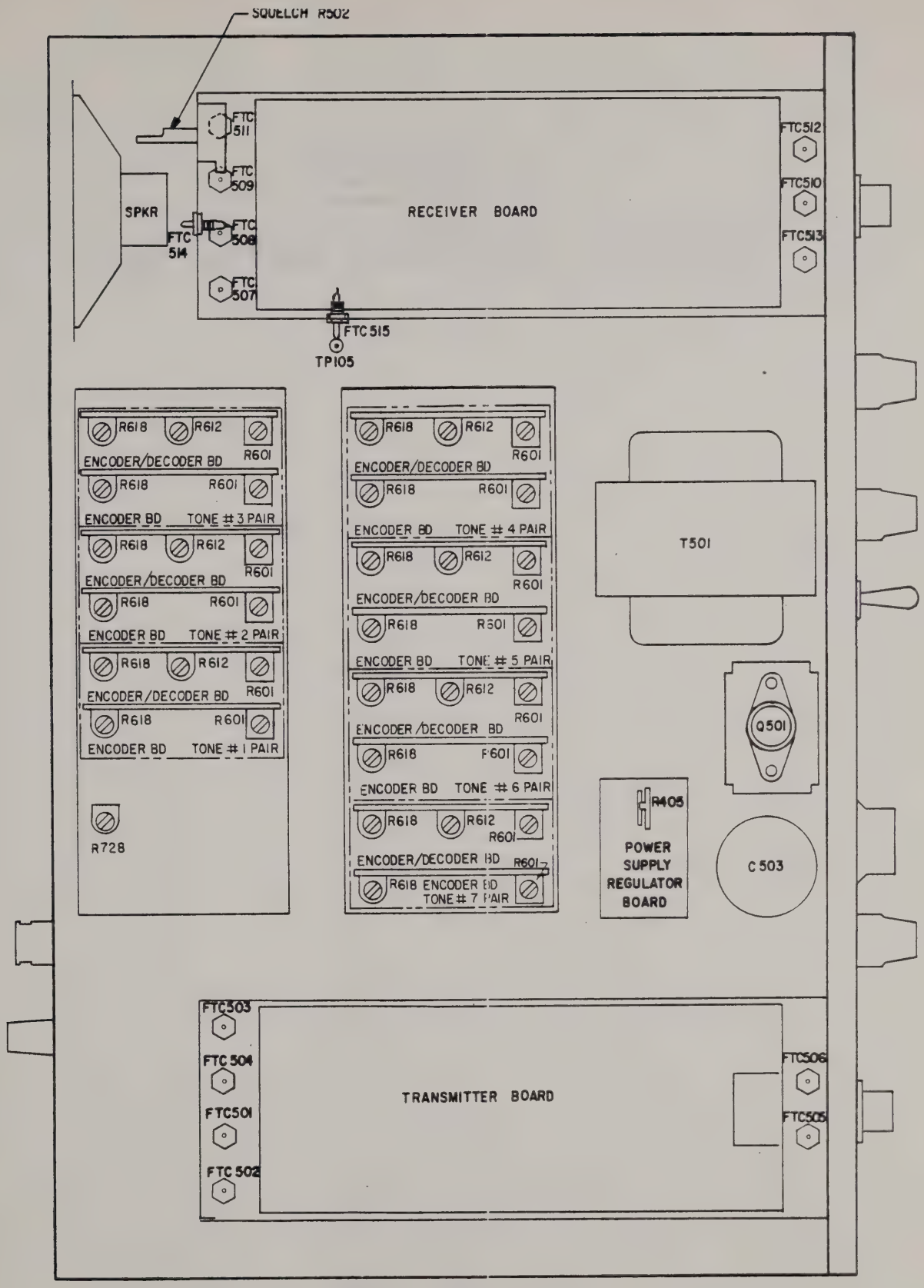


TOP VIEW



BOTTOM VIEW

FIG 6A-9



MA-116 & MA-121
6A-10 SETUP ADJUSTMENT LOCATIONS
TOP VIEW

SECTION 7

REPEATER CONTROL SYSTEM

SECTION 7 REPEATER CONTROL SYSTEM

7-1 REPEATER CONTROL BOARD

An interconnection schematic of the repeater is shown in Figure 7-10. The repeater control functions are performed by the repeater control board, which is shown in detail on the inter connection schematic. The control board components carry 700 series numbers. Follow Figure 7-10 while reading the following.

The control board is arranged to permit operation of the repeater by noise squelch, or by CTCSS (Continuous Tone Controlled Squelch, often abbreviated as "tone squelch") tones.

The U10R repeater is equipped to hold seven different tone decoders, three of these being accommodated on the repeater control board, and four on the auxiliary tone squelch board. Any number up to seven may be installed, but the first one should be installed in P706, located on the repeater control board. Similarly, the repeater is equipped to hold seven different tone encoders, three on the repeater control board, and four on the auxiliary tone squelch board. Any number up to seven may be installed, but the tone generator corresponding to the first tone encoder should be installed in P705.

7-2 AUDIO PATHS

Audio from the receiver is fed to Pin L of the tone receiver in the P706 receptacle. This audio contains both the speech and the CTCSS tone portions of the received signal. An active high pass filter removes those frequencies below about 300 Hz, which includes the CTCSS tones and feeds the remaining signal (now speech only) back to the receiver at Pin J. (In units not equipped with tone squelch, a jumper located on the circuit board adjacent to P701, provides a path between Pin J and L, and no low pass filter action is used.) This speech-only signal is then passed through the noise squelch controlled amplifier in the receiver and fed to the front panel volume control, R501. Audio from the arm of R501 is fed back to the receiver audio power amplifier and raised to loudspeaker levels to operate the local loudspeaker. Thus, R501 controls the volume heard by the local operator and has no effect on re-transmitted audio.

Receive audio, for retransmission, is taken from the high side of R501, passed through the transmitter modulation input control, R728, and sent to the transmitter modulation circuits. Since this audio has passed through the high pass filter in the tone squelch board, it contains only speech components, and does not contain any CTCSS tone. If CTCSS tone is used, the CTCSS tone for the retransmitted signal comes from the appropriate encoder board, as will be explained later.

7-3 TRANSMITTER ACTIVATION BY NOISE SQUELCH

When JU701 is connected to the "Squelch" contact pin, the transmitter will be activated by any signal that is accepted by the receiver's noise squelch system. When a signal is received and the receiver's noise squelch system causes the receiver to become unsquelched, audio amplifier Q113 in the receiver draws current through R501, the front panel volume control. This current creates a drop across R727 that causes Q708 to conduct. Q708 causes Q707 to conduct, which places an effective ground on the cathode of CR712, which causes Q709 to conduct, which then causes Q706 to conduct. Q706 places an effective ground on the PTT terminals of the transmitter, and therefore activates the transmitter.

Squelch Hysteresis Action:

When the transmitter is activated and Q709 is in a conducting condition, Q709 causes Q710 to also be conducting, placing the collector of Q710 near ground potential. The series combination of CR720 and R675 are connected between the K line to the receiver squelch and the collector of Q710. When Q710 conducts, its collector, acting through CR720 and R765, pulls the receiver squelch K line toward ground, forcing the receiver noise squelch into a more "unsquelched" condition. This action prevents the dropout of weaker signals from mobiles when the mobiles pass through low signal areas. The effect of this circuit is to add a large amount of "hysteresis" to the operation of the squelch system. That is, the signal required to hold the squelch open (once energized) is thus less than that required to open the squelch in the first place.

In some systems, it may be found that this "hysteresis" action is excessive, and permits unduly noisy signals to hold the repeater transmitter on. The amount of hysteresis action may be reduced by increasing the size of R765.

7-4 TRANSMITTER ACTIVATION BY CTCSS (TONE SQUELCH)

When JU701 is connected to the "tone" contact pin, the receiver noise squelch is no longer in control of the activation of the transmitter. In this condition, tone decoders, tuned to specific subaudible tones, activate the transmitter when the appropriate tone is detected on a received signal.

To follow the operation under tone squelch (CTCSS) control, assume that a tone decoder board for 127.3 Hz had been installed in the P706 connector of the repeater control board, and that a tone encoder for the same frequency has been installed in the corresponding P705 connector, also on the repeater control board. Also assume that JU703, a wire jumper on the circuit side of the circuit board adjacent to P706, has been removed.

Unsquelched audio from the receiver is connected to Pin L of all of the CTCSS tone receivers. When no tone is being received,

Pin K of all tone receivers will have a positive voltage causing Q702, Q705, Q706, Q802, Q804, Q806 to be conducting, and Q701, Q703, Q705, Q801, Q803 to be non-conducting. When a signal with 127.3 Hz tone is received, the 127.3 Hz tone receiver in P706 will sense the presence of the tone, and the positive voltage will disappear from its K terminal, causing Q706 to be non-conducting, thereby causing Q705 to be conducting. Current pulled by the collector of Q706 pulls current through LD703 and CR712, causing LD703 to light, and causing Q709 to conduct. The conduction of Q709 eventually causes the transmitter to be activated in the same manner as it would be in the noise squelch operation mode described earlier.

The conduction of Q709 also causes Q710 to conduct, placing its collector near ground potential. The series combination of CR720 and R675 are connected between the K line to the receiver squelch. When Q710 conducts, its collector, acting through CR720 and R765, pulls the receiver squelch into a more "unsquelched" condition. This action prevents the dropout of weaker signals from mobiles when the mobiles pass through low signal areas.

When no CTCSS tones are received, the cathodes of CR709 and CR710 are held at a positive voltage by R719. CR709 and CR710 constitute a diode switch. In this condition, the switch is open, preventing the output of the tone encoder (Pin F, P705) from reaching the transmitter tone input terminal F. Similar diode switches prevent the output of other tone encoders from reaching the transmitter tone input. When a 127.3 Hz tone is received, the action of the tone receiver board located in P706, and the action of Q806 and Q705 cause the voltage on the cathodes of switch diodes CR709 and CR710 to disappear. The diodes are then forward biased by current through R715 and R716, and therefore will conduct the tone from the P705 tone generator to reach the tone input to the transmitter.

7-5 OPERATION BY LOCAL MICROPHONE, PTT FUNCTION

The local microphone may be used for dispatching from the repeater location, or for testing the repeater station during maintenance procedures. The microphone supplied is a model MA-83. This is a ceramic type microphone with a switch section that disconnects the microphone element when the PTT switch is released.

One pole of the microphone PTT switch is connected to Pin 3 of the microphone connector J501. Inside the transmitter, Pin 3 goes to the coil of the PTT relay. Since the other side of this relay is connected to plus 13 volts, approximately 13 volts appears at Pin 3 of the microphone jack. This voltage acting through CR718, causes Q718 to be conducting. When the PTT switch is closed, the voltage at Pin 3 drops to zero, causing Q718 to become non-conducting, which results in a positive voltage appearing on the Q718 collector. This voltage, acting through R751, is connected to

the base of the receiver noise rectifier filter, causing the receiver to become squelched, and thereby preventing the retransmission of any received audio during the time the local microphone is depressed.

If the repeater is equipped with tone, the tone select test lead JU103 is normally connected to contact TP703. When the microphone button is depressed, TP703 is pulled almost to ground, causing CR709 and CR710 to conduct, thereby permitting the tone generated by the tone encoder in P705 to be delivered to the transmitter tone input. Thus, the 127.3 Hz tone assumed above will be transmitted when the local microphone switch is operated.

If it is desired to actuate other tones for test purposes, the Tone Select lead JU103 may be connected to the appropriate tone selection contact for the desired tone, i.e., TP701, TP702, TP801, TP802, TP803, TP804. When the microphone PTT switch is activated, the CTCSS tone associated with the selected contact will be transmitted. After the test, be sure to return JU103 to TP703 for normal operation.

7-6 TONE MONITORING PROVISIONS

Assuming that the tone select test lead is connected to TP703, and that a 127.3 Hz tone decoder is plugged into P706, the positive voltage of Pin K of P702 (under the no-tone received condition), acting through R759 and R560 causes the diode audio switch consisting of CR719 and CR720 to block audio from the arm of the front panel volume control R501, preventing audio from reaching the receiver audio power amplifier, and the local loudspeaker.

When a tone of 127.3 Hz is received, TP703 is no longer positive, and the diode audio switch CR719-CR720 is switched to the pass condition, permitting the received audio signal to pass from the arm of the front panel volume control to the receiver audio power amplifier and thus the signal can be heard over the local loudspeaker. Note that this received audio must pass through the noise squelch circuit of the receiver as well as audio switch CR719 and CR720.

The above has described the operation when the microphone is in its grounded hanger. When the microphone is in its hanger, only signals bearing the specific tone installed in P706 will be heard in the loudspeaker. The microphone hang-up button is connected through the microphone cable to Pin 5 of the microphone connector J501, placing a ground on the base of Q717, which causes Q717 to be non-conductive. Under this condition, only the signals bearing the 127.3 Hz tone assumed above will be heard in the local loudspeaker, as described above.

When the microphone is lifted from its hanger, the base of Q717 is pulled positive by R749, causing Q717 to conduct, forcing the diode switch CR719-CR720 to be in the pass condition, regardless of the voltage coming from TP703. Under this condition, referred to as the "MONITOR" condition, all audio signals that pass through the receiver noise squelch system will be passed on to the receiver audio amplifier and the local loudspeaker. This "MONITOR" condition permits the operator to listen on the channel before transmitting, and thus avoid breaking up an ongoing communication on the channel.

Summarizing the action of the microphone hang-up button, and its monitoring actions:

When the microphone is in its hanger, all received signals with appropriate tone squelch frequencies (those for which a tone decoder has been installed) will be retransmitted by the repeater, but only those signals bearing one specific tone (selected by the placement of the tone-select test lead, JU703) will be heard in the local loudspeaker. This enables the local operator to avoid being bothered by transmissions over the repeater which do not concern him.

When the microphone is removed from its hanger, all received signals, regardless of whether they have the correct tone, or any tone, will be heard in the local loudspeaker. This permits the operator to monitor activity on the channel before transmitting.

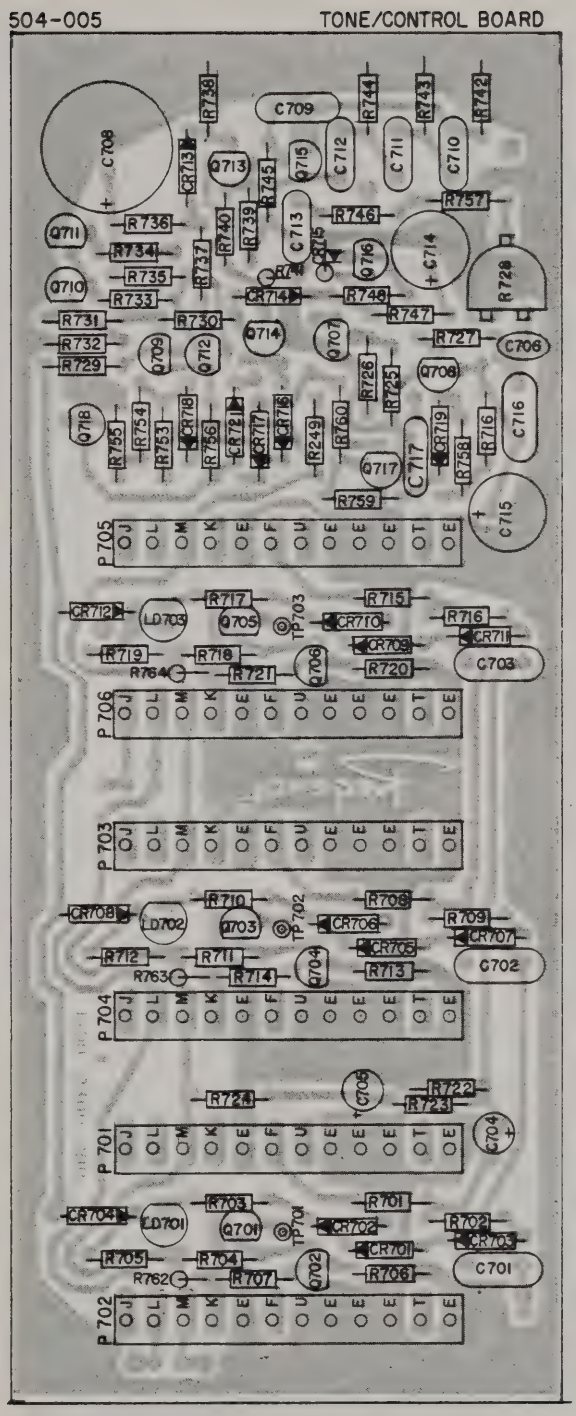
7-7 THREE MINUTE TIMER, DROP-OUT DELAY, TIME-OUT WARNING OSCILLATOR

When the transmitter is not activated, Q709 is non-conducting, causing Q710 to be non-conducting, causing Q711 to be conducting.

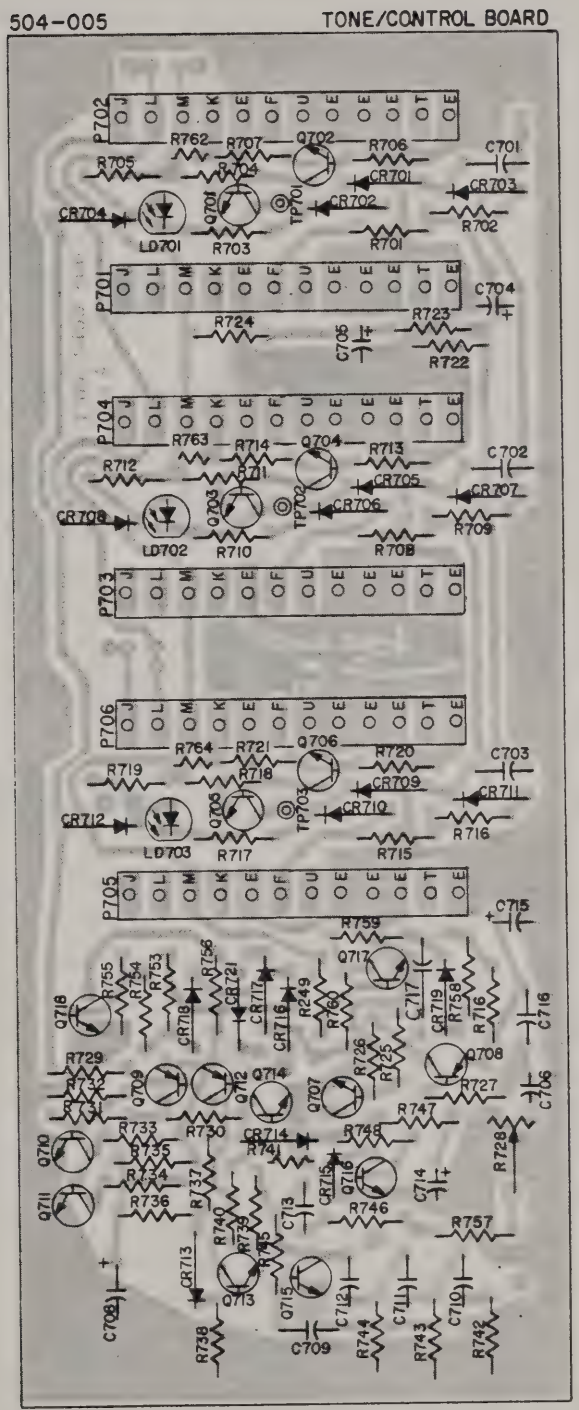
Since the collector of Q711 is shunted across timing condenser C708, C708 cannot be charged through R735. When the transmitter is activated by the receipt of a signal, Q710 is turned on which makes Q711 non-conducting, thus removing the short across C708. C708 then is slowly charged through R735. When C708 becomes charged to about 1.2 volts, it causes Q713 to conduct. Once Q713 begins conduction, it turns on Q712 which puts more base current into Q713, causing it to conduct heavily and turn on Q714. Q714 acts as a short across the line leading to the base of Q716, turning Q716 off. Since Q716 collector is connected to the PTT lead of the transmitter, the short it creates between this lead and ground is removed, and the transmitter turns off as soon as the drop-out delay capacitor C714 is discharged.

When Q713 becomes conductive, it also supplies collector current to the time-out warning oscillator, Q715. Q715 is connected as a phase shift oscillator and its output is connected into the transmitter modulation input. The beep from the time-out warning oscillator is transmitted during the few seconds of the drop-out

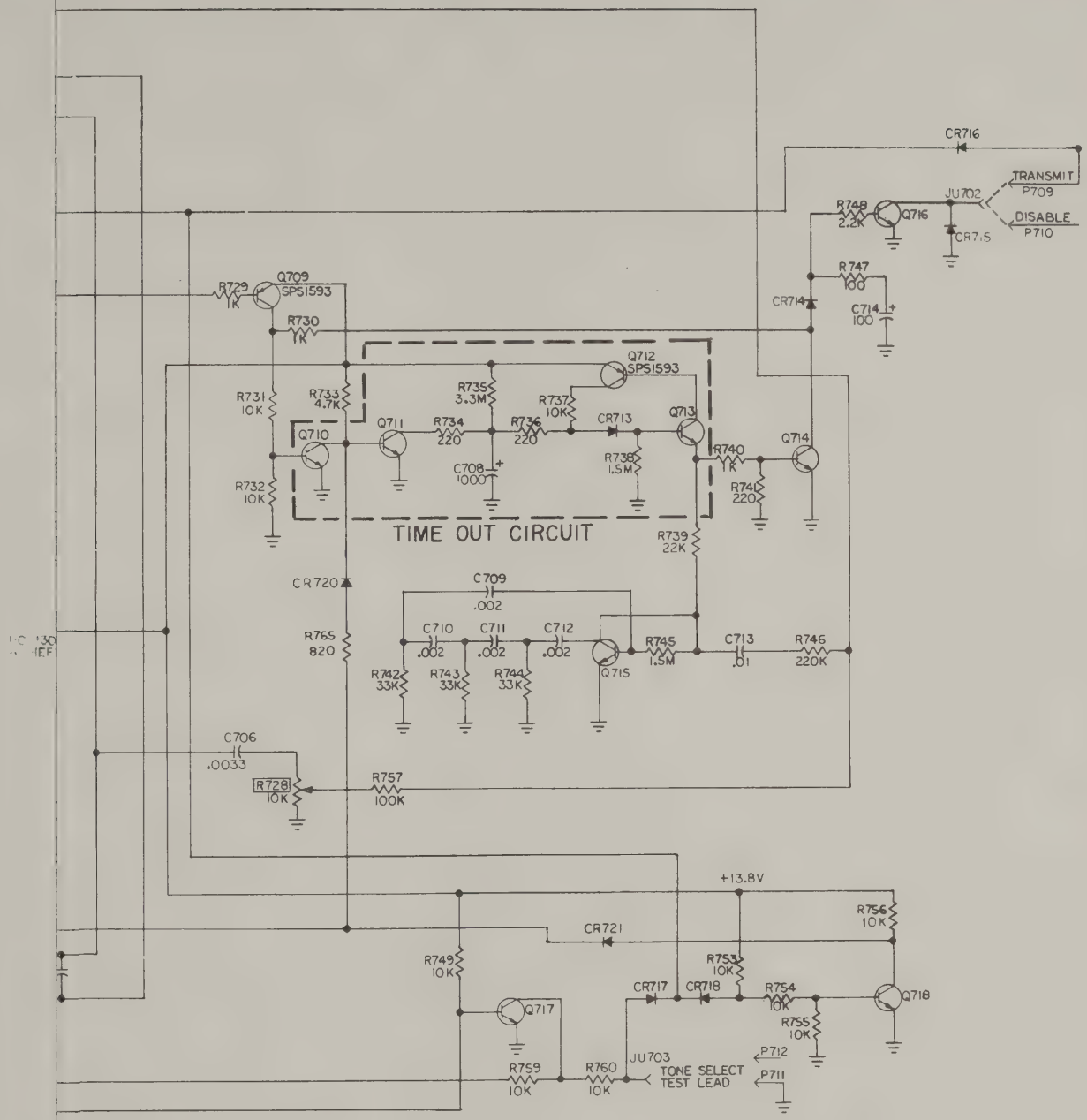
delay caused by C714. C714, in the base circuit of Q716 serves as a "drop-out delay." While the transmitter is turned on, C714 becomes charged. When the received signal disappears, the charge on C714 holds Q716 in conduction for about two seconds. Thus, the transmitter remains activated for about two seconds after the received signal disappears.



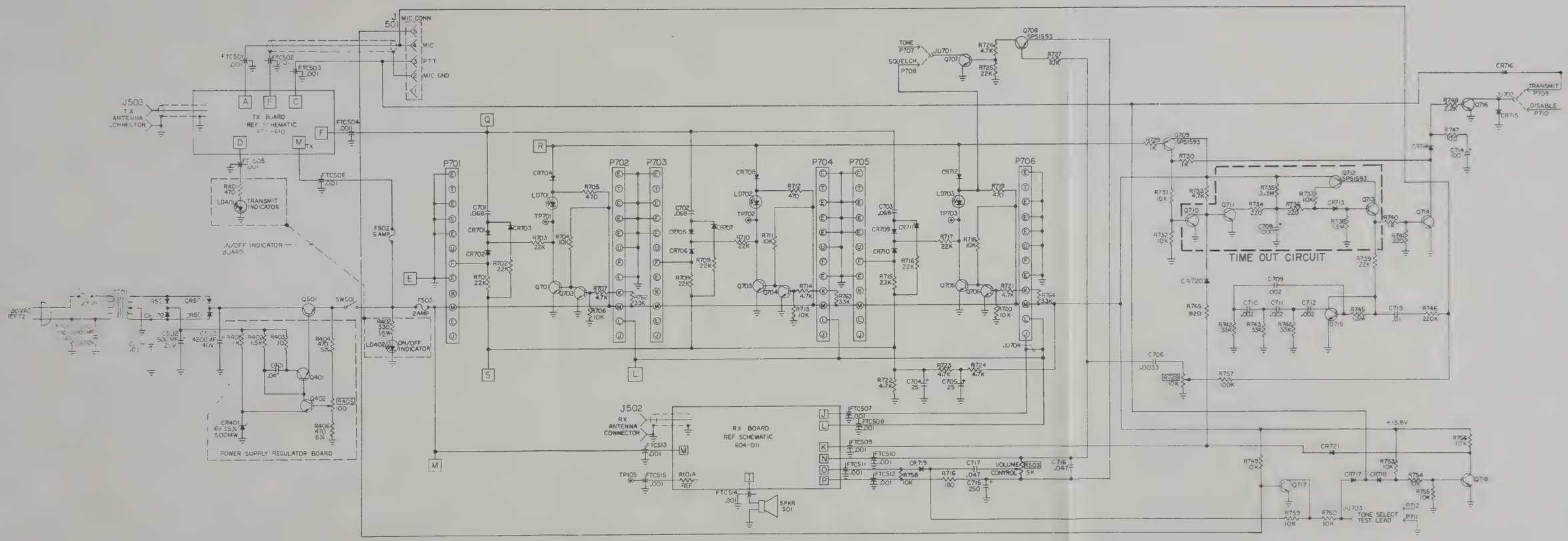
7-8 REPEATER CONTROL BOARD TOP VIEW



7-9 REPEATER CONTROL BOARD BOTTOM VIEW



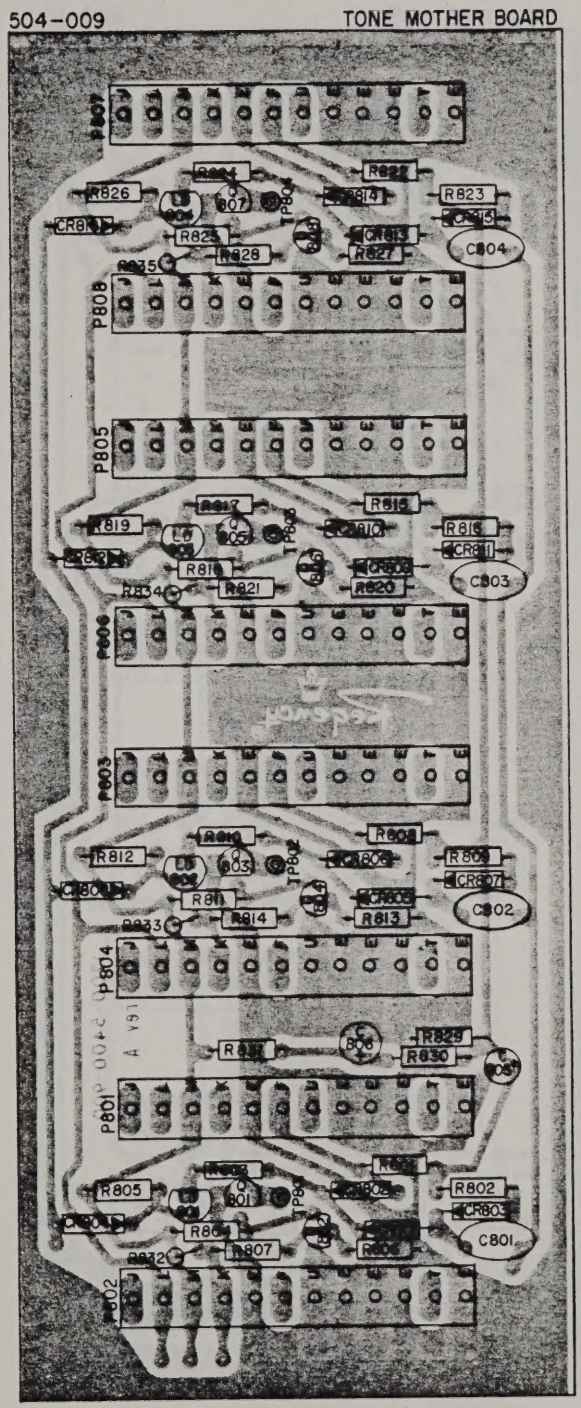
7-10 REPEATER INTERCONNECTION SCHEMATIC
INCLUDING REPEATER CONTROL BOARD



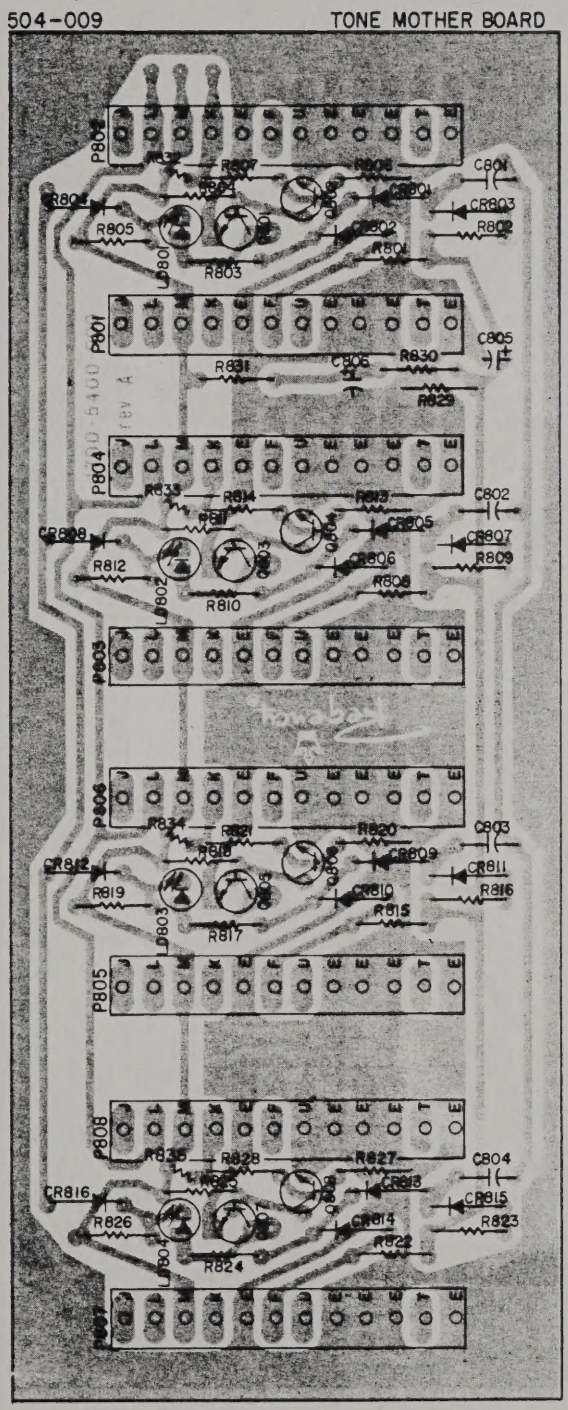
NOTES

1. ALL RESISTORS ¼ W UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE MICROFARADS UNLESS OTHERWISE NOTED
3. ⟋ DENOTES ADJUSTABLE COMPONENTS.
4. HEAVY LINE DENOTES APPARENT SIGNAL FLOW.
5. ALL VOLTAGES (FIGURES IN PARENTHESIS) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 117VAC 60HZ AT INPUT TO SUPPLY CABLE.
6. PART DESIGNATION NUMBERS INDICATE LOCATION.
   - 100 SERIES R_x BOARD REF SCHEMATIC 604-011.
   - 200 SERIES T_x BOARD REF SCHEMATIC 604-010.
   - 300 SERIES UNASSIGNED
   - 400 SERIES
     - (a) POWER SUPPLY REGULATOR BOARD
     - (b) ON/OFF INDICATOR BOARD
   - 500 SERIES CHASSIS MOUNTED
   - 600 SERIES
     - (a) TONE PLUG-IN MODULE (ENCODE/DECODE) REF SCHEMATIC 501-275
     - (b) TONE PLUG-IN MODULE (ENCODE ONLY) REF SCHEMATIC 304-007.
   - 700 SERIES TONE CONTROL BOARD.
   - 800 SERIES TONE MOTHER BOARD REF SCHEMATIC 604-009

7-10 REPEATER INTERCONNECTION SCHEMATIC INCLUDING REPEATER CONTROL BOARD



7-11 AUXILIARY TONE BOARD TOP VIEW



7-12 AUXILIARY TONE BOARD BOTTOM VIEW